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RAILWAY
MECHANICAL ENGINEER

Development of

Pacemaker Box Cars*

By P. W. Kiefer†—A. M. Miers† and L. D. Hays† Collaborating

Discussion of the special features provided for protection of lading and equipment—Comparative test results of five high-speed trucks and a standard type are presented—The need for the further study of instrumentation is suggested

THE principal betterments incorporated in the New York Central System Pacemaker box cars consist of progressively improved trucks for higher degrees of protection against the lateral and vertical shocks of operation, high-speed pneumatic brake equipment combined with non-load-compensating rigging for the higher braking ratios, and a double-acting cushioning device [Waughmat] installed back of the couplers.

The car bodies are of A.A.R. standard design of carbon-steel riveted, which is the best yet produced for interchange service. For the past decade no comprehensive or conclusive studies have been made for the establishment of an improved A.A.R. standard construction, with due regard for materials, methods of fabrication and the use of approved competitive and fully interchangeable features, such as doors, ends, roofs, and other items. However, a number of the fundamental features of the present A.A.R. standard design are used in all of the high-tensile low-alloy-steel box-car body constructions, welded or otherwise, offered by the different builders during recent years.

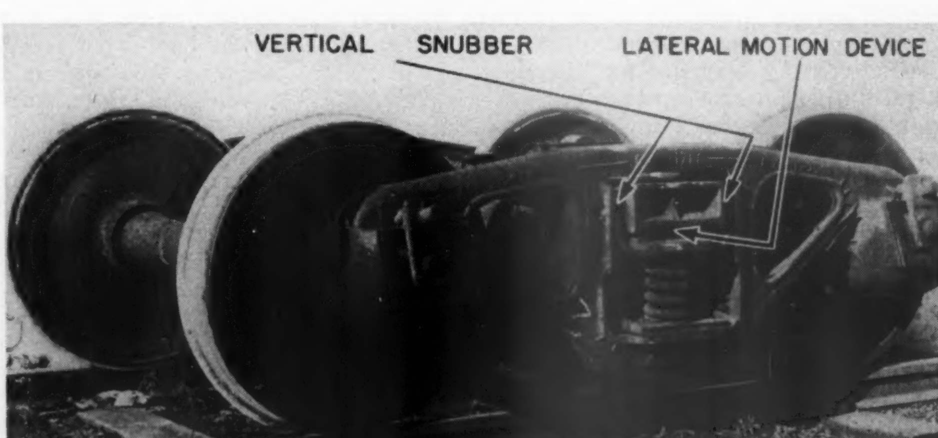
Trucks

Conventional Spring-Plankless with Unit Snubbers—This integral box, non-lateral-motion spring-plankless truck is generally representative of the designs extensively used in regular interchange freight service. It is not installed under any of the Pacemaker cars, but is included in the performance results as the base from which subsequent progress has been made. The suspension springs are of the 1936 A.A.R. design for 40-ton nominal capacity cars, consisting of three outer coils and one inner coil having a free solid travel of 1-5/8 in. A typical friction snubber is contained in each spring group. Relative lateral movement between bolster and side frames is limited approximately to 1/16 in. each side of the center. The wheel-base length is 5 ft. 6 in. and the weight per truck is 7,000 lb. fully equipped.

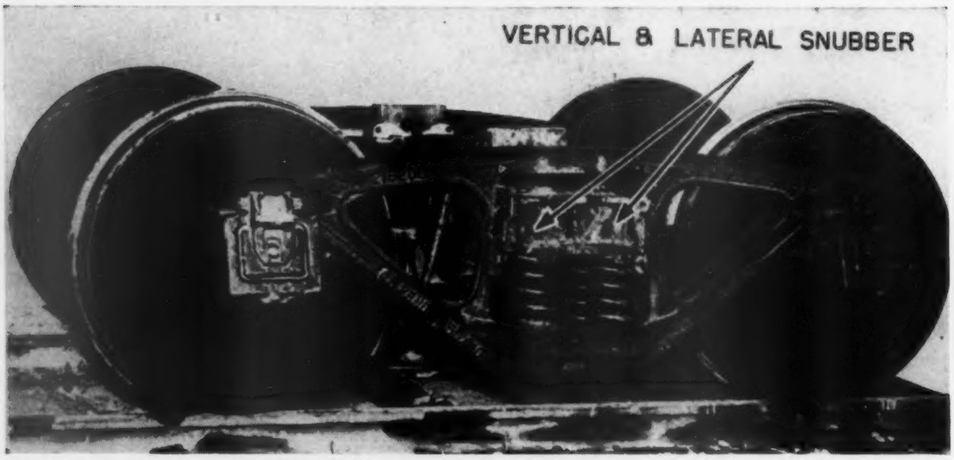
Standard Car Truck Company Type S-1-L—This integral-box spring-plank truck with lateral-motion bolster has suspension springs to suit a 50,000-lb. maximum revenue load and free-to-solid travel is 2-1/8 in. Vertical snubbing is accomplished by means of the Barber stabilizer, consisting of spring-actuated friction shoes at each side of the bolster with liners on the contact surfaces of the side-frame columns. The lateral-motion bolster has 1-1/8 in. relative movement each side of center

*Abstract of a paper presented at the annual meeting of the American Society of Mechanical Engineers held at New York November 25 to December 3, 1948, as a contribution of the Railroad Division.

†Mr. Kiefer is chief engineer of motive power and rolling stock; Mr. Miers, assistant engineer, and Mr. Hays, air-brake engineer, of the New York Central System.



Type S-1-L truck of the Standard Car Truck Company with vertical snubbers and Barber lateral-motion device



American Steel Foundries Type A-3 truck with vertical and lateral snubbers

and is positioned on rollers which function between contour surfaces on the underside of the bolster and on spring-seat members supported on the suspension springs. The wheel base of this truck is 5 ft. 6 in. The weight, completely equipped, is 7,500 lb. each.

Standard Car Truck Company Type S-1-L-P—All details of this truck are identical to truck Type S-1-L, except for the use of the pedestal-type side frame with coil springs over the separate boxes and for the resulting increased length of wheel base. Here, again, suspension spring capacity for a maximum revenue load of 50,000 lb. is provided. Total free-to-solid travel is 4-11/16 in., divided 2-9/16 in. for the pedestal springs and 2-⅛ in. for the bolster springs. The weight complete, is 8,900 lb. The wheel base is 5 ft. 10 in.

Symington-Gould Type XL—Both vertical and lateral cushioning of this pedestal-type spring-plankless truck, with controlling means, are incorporated entirely at the journal boxes. Suspension springs here used are of a capacity suitable for 50,000 lb. maximum revenue load and have free-to-solid travel of 3-13/16 in. as tested. Later this was changed to 4 in. The journal boxes are provided with longitudinally extending wings at the bottom which serve as seats for two suspension springs. Relative lateral movement between the side frame and journal box each side of center position is ⅝ in. Vertical and lateral snubbing is accomplished through spring-actuated friction shoes at each side of the journal boxes which operated on liners within the frame pedestals. Truck-frame unsquaring is prevented by an interlock between bolster and side frame, which also permits rocking of the side frame in a vertical plane for assistance in wheel-load equalization. This truck, complete, weighs 8,100 lb. and has a wheel base of 5 ft. 6 in.

Chrysler Design—Symington-Gould Type FR-5D—This truck was designed by the engineers of the Chrysler Corporation on fundamental requirements supplied by the railroad engineers and now further refined in detail cooperatively by Chrysler and Symington-Gould. For lateral cushioning, an arrangement of relatively short swing hangers, pivoted below the axle center to provide side-frame stability, is incorporated in the integral box-type side frame and confined within the lower center-frame members for protection against possible failures. The spring plank prevents truck-frame unsquaring by means of special contour bearings between it and the swing hangers. Suspension springs of the capacity desired may be installed, but, as in the previous cases, those used are made suitable for 50,000 lb. maximum revenue load, with free-to-solid travel of 3-⅞ in., and are controlled by special external snubbers equipped with composition lining on the friction shoes. Relative lateral movement between bolster and frame, each side of center, is 1¼ in. Relative lateral movement between bolster and plank under lateral deflection of the supporting springs is limited to 5/16 in.

The weight of this truck, fully equipped, is 7,900 lb. The wheel base is 5 ft. 6 in.

American Steel Foundries Type A-3—This integral-box spring-plankless truck was not installed under any of the Pacemaker cars, but was included among the trucks tested to which reference is made later. The bolster-supporting springs used have free-to-solid travel of 3-11/16 in. and capacity suitable for maximum lading of 50,000 lb. Vertical and lateral snubbing is effected by means of a spring-actuated shoe arrangement at each side of the bolster which moves against linered surfaces of the side-frame columns. Relative movement between bolster and side frame, each side of center, is ¼ in. Wheel-base length is 5 ft. 6 in. and the weight per truck, fully equipped, is 7,100 lb. Although not used in the Pacemaker trains, a total of 4,200 New York Central System regular freight-service box and hopper cars are equipped with this truck, sprung for maximum A.A.R. rail loading.

Brake Equipment

The present standard AB brake for freight cars, adopted in 1933, was developed primarily to meet the demands for improved control of train slack action during braking of heavier and longer trains. For the Pacemaker box cars new conditions were to be met and it was realized that the pneumatic brakes and associated rigging of these units would have to be such as satisfactorily to meet the requirements within available signaling and yet to be suitable for operation in regular freight trains when desired. The problem was presented to the air-brake manufacturers, with whom the railroad continued to co-operate. Following a period exceeding two years of intensive effort, this work resulted in the development of the high-speed freight brake known as the AB-1-B, based on the standard AB equipment.

With this brake, when set for high-speed service, the development of brake-cylinder pressure during service-brake applications is the same as for the AB equipment, except that a safety valve is connected to the brake cylinder which limits a full-service application to 60 lb. cylinder pressure. When an emergency application takes place, this safety valve is isolated from the brake cylinder, thereby permitting the cylinder pressure to reach its full equalization value of 95 lb. with brake-pipe pressure at 110 lb. This arrangement provides a large spread of braking force between full-service and emergency brake applications, the same as with passenger-train brakes, rather than the difference of about 20 per cent available in regular freight operations.

During an emergency brake application, when set for high-speed service, the development of brake-cylinder pressure is direct and not in three stages as is the case with the standard AB equipment, but when operating in regular freight trains where no signal-pipe air pressure is made available, the AB-1-B control valve is automatically adjusted to provide the three-stage build-up of cylinder pressure.

The foundation-brake rigging of the Pacemaker cars is of the single-shoe non-load-compensating type, but of sufficient strength for the braking ratios of 90 and 140 per cent of the car light weight for full-service and emergency applications, respectively. These ratios are obtained with 110 lb. brake-pipe pressure used in high-speed service and automatically are reduced to conventional freight ratios when reverting to correspondingly lower brake-pipe pressures used in the movement of regular freight trains.

During the early design stages of the Pacemaker box cars it was estimated that signal spacing then existing between New York and Buffalo was such as to permit a maximum load stenciling of 50,000 lb. per car with a speed limit of about 65 m.p.h. As soon as trains of these cars became available, stop-distance checks were made which confirmed these calculations and also indicated a maximum train length of about 65 cars. At the same time it was established that, with the type of double-acting cushioning devices used in the connections of these cars, excessive shock action would not develop under conditions of low-speed emergency braking and that, under normal braking practices from all speeds, the related train action was exceptionally smooth.

During experience to date with the type of high-class merchandise lading handled in the Pacemaker trains, the load per car has ranged from 8 to 15 tons, and, on the average, about three-quarters of the cubical capacity has been used. From this it follows that the actual braking situation is more favorable than above indicated and that a speed limit up to approximately 70 m.p.h. is available under the present operating set-up, if needed.

Connections Between Cars

The double-acting cushioning device installed back of the couplers, known as the Twin Cushion, consists of a series of synthetic- or natural-rubber rings or pads bonded through openings in a steel plate. In each assembly the rubber-spring units, separated by flat divider plates, are installed in two groups, one for pull enclosed in the coupler yoke and the other for buff, with both placed under sufficient precompression to produce the desired travel and load characteristics.

The purpose is the substitution of cushioned resiliency for free slack in either direction of coupler movement, with total car-connection slack reduced to the extent possible when the standard automatic coupler is used. This is especially helpful while braking or otherwise decelerating, and similar advantages also are made manifest while starting, accelerating and running, and during any reversal of coupler load.

One of the car-connection features here incorporated which contributes importantly to the highly desirable reduction in free slack and protection against pulled-out couplers consists of the pin-type connection between coupler shank and yoke. This assembly, or its equivalent, is far superior to the cross-key arrangement—long obsolete in this writer's opinion—as used on the great majority of revenue freight cars. Although established as an A.A.R. Alternate Standard and applicable to the yoke used with any authorized friction draft gear, as well as to that of the cushioning device here described, it is frequently ruled out for new cars because of the relatively small additional first cost. This is a short-sighted policy.

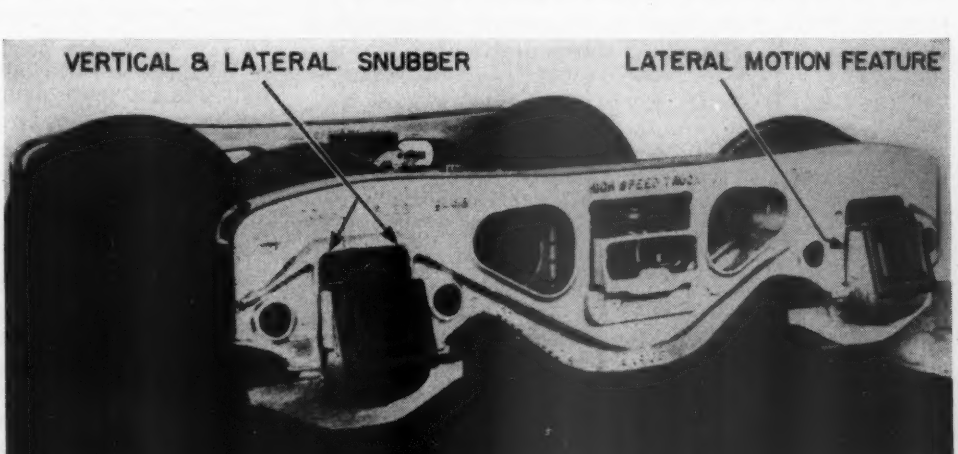
Although to date it is not in service on any of the Pacemaker box cars, as the result of close co-operative work by the A.A.R. Committee on Couplers and Draft Gears and the Mechanical Committee of the Standard Coupler Manufacturers, the tight-lock coupler principle now is made available for freight operations. The work has been advanced to the stage where trial applications have been made, under A.A.R. sponsorship, to three Pennsylvania special-service box cars, with additional installations scheduled for three New York Central System interchange freight cars of a type not yet selected. In due time others are to follow.

Through the aid of experience with the A.A.R. passenger-service tight-lock coupler it was found possible to design the shank and attachments in such a manner as to make the new design applicable to existing freight cars of conventional construction, substituting only a striking casting to accommodate the necessary spring-supported carrier where the latter is not already in use. The interlocking wings are similar to those of the passenger tight-lock coupler so that they may be coupled together. The anti-creep, lock-set and knuckle throw are the same for both couplers. Machine finishing has been dispensed with and the normal free slack per pair of couplers has been reduced to 3/8 in., which is approximately one-half the amount present with the standard Type E.

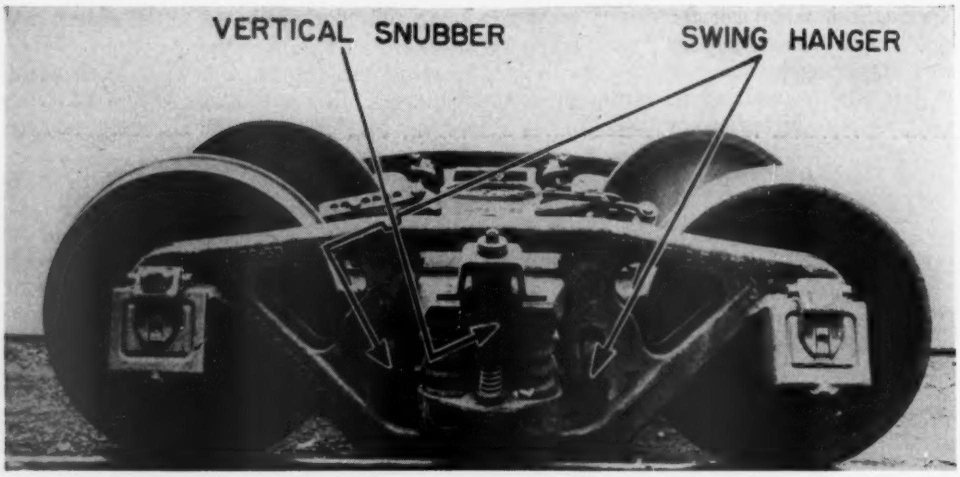
In the event that this or subsequently modified designs prove practical for freight cars at reasonable cost, this further reduction in free slack, with correspondingly bettered control of the surges between freight cars, may be accomplished as an additional step in the desired direction.

Comparative Operating Tests

For checks of the results obtained from the truck de-



The Symington-Gould Type XL pedestal truck



The Symington-Gould Type FR-5D truck of Chrysler design

velopment and design work already described, a series of road tests has been progressed over the past two and one-half years in which special trains having consists made up substantially of a baggage car, two 50-ton steel-sheathed box cars equipped with instruments, and a coach, hauled by a 4-6-4 passenger locomotive of ample capacity, have been used over the same trackage in all cases. Each individual run consisted of an eastbound and a westbound movement of 57.5 miles over good main-line double-track rock-ballasted roadbed and rail ranging from 118 lb. to 131 per yard, with numerous intermittent curves and tangents.

The two instrument cars operated in each run are of identical construction. The recording equipment and the manner in which it functions in this type of work is of first importance.

Vertical Accelerometers

Each vertical accelerometer assembly is housed in a metal frame attached to the car floor. It contains a 100-lb. movable weight guided by rollers and held against the top of the frame by an adjustable spring beneath the weight. The calibration setting of each individual element is determined by the pressure this spring is caused to exert above that required to neutralize the effect of the 100-lb. weight. Vertical upward shocks on the car-floor structure are transmitted to the frame and through the spring to this weight. If the shock is greater than the value for which the spring pressure is set, it compresses the spring and causes a downward motion of the weight with relation to the frame of the instrument. When this motion amounts to 0.005 in. a switch mounted on the top of the instrument breaks an electric circuit in which is a sensitive counter which registers the shock. Each test car is fitted with four of these instruments located at the center of the floor space and set, respectively, from experience for .25, .35, .50 and .75 values of gravity.

Lateral Accelerometers

Each lateral accelerometer is contained in a suitable metal housing and functions similarly to the vertical accelerometers just now described. Each of the five pendulum-shaped weights per instrument is hinged at the top through a flexible steel reed in such a manner that relative movement between the suspended weight and the housing can take place only in the lateral plane. The masses of these vertically positioned pendulums are exactly equal and each weighs approximately four-tenths of a pound. Each pendulum weight is held against a stop, an integral part of the housing, by a tension spring adjusted to the acceleration setting desired. The settings are .20, .30, .40, .50 and .60 values of gravity, respectively.

A lateral shock which exceeds the setting of a tension spring causes relative movement of the housing assembly with respect to a pendulum weight. When such movement exceeds 0.010 in., electric contact is made between the weight and an integral portion of the housing, causing registration on a sensitive counter.

The instruments are mounted in oil-damped pendulum bases which serve the dual purpose of maintaining constant calibrations, regardless of car-floor unleveling when negotiating curves or from other causes and nullifying the effects of centrifugal forces on the pendulum weight elements. One of these devices is positioned over the bolster at the trailing end of each test car.

Thus, with the two designs of instruments used, continuous records of the vertical and lateral accelerations are registered simultaneously in terms of gravity within the car bodies when operating over curves or tangents, for each design of truck tested.

The revenue load of 25,000 lb. has proved adequate in actual service because only occasionally has the l.c.l. lading per car exceeded this figure by a small amount. The resulting load on the rail is 73,000 lb.

Test Results

Representative results from this series of comparative tests are shown in a table. It is noted that truck performance, both lateral and vertical, is expressed in terms of "lading-damage factor units." This is a method of evaluation in which relative values are assigned to the acceleration counts of the various magnitudes in proportion to the square of the acceleration intensity. The observed number of counts of each acceleration intensity is multiplied by the corresponding weighting factor and all of the weighted counts are added together. This method was developed in 1933 by a subcommittee of the A.A.R. Committee on Car Construction and has since been used, where applicable, in road tests conducted under the sponsorship of the A.A.R., Mechanical Division, as well as by various railroads and truck manufacturers.

The runs here set forth were not selected from the best performances, but were chosen so as to provide representative results in a condensed form not requiring prolonged study or laborious analyses, but, withal, consistent with the large amount of data accumulated for the Barber S-1-L and S-1-L-P trucks, the Symington-Gould Type XL, and the Chrysler design Type FR-5D.

The lateral performance of the Chrysler truck, shown in Column 4, is the least favorable produced with this design, including the results of certain tests made with springs for 100,000 lb. instead of for 50,000 lb. maximum lading. This applies, likewise, to Column 5 for vertical action of the same truck in the runs made with the 50,000-lb. springs.

Comparative Road Test Results with High-Speed Freight Car Trucks

	Col. 1	Col. 2		Col. 3		Col. 4		Col. 5	
Date of test	Sept. 17, 1946	June 19, 1946		Nov. 19, 1947		July 23, 1948		July 30, 1948	
Max. speed, m.p.h.:									
Eastward	75	77		65		75		81	
Westward	78	82		83		82		86	
Average speed, m.p.h.									
Eastward	63.1	51.6		55.6		53.7		62.5	
Westward	61.5	62.3		65.2		62.8		58.6	
Lading, lb.	25,000	25,000		25,000		25,000		25,000	
Capacity of springs, revenue load, lb.	80,000	50,000		50,000		50,000		50,000	
Truck designs	Conven. spring plank-less, unit snubbers	Barber S-1-L-P	Symington-Gould XL	Chrysler design FR-5C. S-G	Barber S-1-L	Chrysler design FR-5D. S-G	A.S.F. A-3	Chrysler design FR-5D. S-G	A.S.F. A-3
Max. lateral movement each side of center in.	1/16	1-1/8	5/8	1-1/4	1-1/8	1-1/4	1/4	1-1/4	1/4
Total spring deflection, free-to-solid, in.	1-5/8	4-11/16	3-13/16	3-13/16	2-1/8	3-7/8	3-11/16	3-7/8	3-11/16
Average loaded spring height, in.	7.81	8.42-7.47*	7.04	8.33	7.36	8.43	8.56	8.47	8.56
Average spring deflection loaded car at rest, in.	0.44	1.03-0.78*	1.98	2.05	0.83	2.08	1.69	2.04	1.69
Vertical lading damage factor:									
Total	5,447	520	184	189	3,488	126	3,629	349	1,605
Eastward	2,553	141	29	36	509	37	1,262	121	712
Westward	2,894	379	155	153	2,979	89	2,367	228	893
Lateral lading damage factor:									
Total	32,094	3,174	1,335	197	3,021	1,380	3,240	466	4,039
Eastward	19,099	1,061	560	19	914	416	1,582	185	1,492
Westward	12,995	2,113	775	178	2,107	964	1,658	281	2,547
Now used in Pacemaker merchandise trains	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No

Note: Cast-steel wheels 33 in. diameter ground tread.
*At pedestal and bolster, respectively.

With the vertical accelerometers placed centrally over the underframe, which, in turn, is supported at the truck center plates, it is recognized that because of a certain amount of flexibility in the steel bodies of the test cars, the action of this instrument is moderated while at the body bolster, where the lateral accelerometer is placed there is little, if any, transverse car-body flexibility. At the same time it is recalled that the counter of each vertical accelerometer registers only when the relative motion of the weight amounts to 0.005 in., whereas, with the lateral accelerometer, the movement must be 0.010 in., or twice as much, before a count is recorded.

The influence of speed in terms of the correspondingly ascending dynamic force reactions with the different trucks is evident. For the most part, a quite definite relationship is shown between the vertical-force magnitudes and the amounts of controlled bolster-spring-suspension travels used.

On the effects of restricted bolster-spring-suspension travel of the Barber Type S-1-L truck, Column 3, with respect to vertical performance, it is fairness to state that, since made available for the Pacemaker cars, designs of this truck have been produced incorporating springs of longer travel with which, unquestionably, vertical accelerations lower than those shown would be obtained.

Suggestions for Future Instrumentation

Over the past several years, much constructive work and experimentation have been devoted to the development and use of recording mechanisms for the purpose here under consideration. Different arrangements of such apparatus have been used, including small portable machines with which the movement of stylus needles, attached to and actuated by undamped pendulum weights, are recorded on a tape. Although definitely valuable for a number of purposes and convenient because of portability, they do not meet the need here dealt with, largely because of the acceleration effects on the pendulums and related parts.

A much better method has been the use of accelerometer type instruments with which separate totals of lading-damage-factor counts for lateral and vertical force reactions may simultaneously be accumulated during each run, but, thus far, in the experience of this writer, none of the procedures employed with instruments of this type produces data from which may be derived the *ratio* or the directly comparable values of these two disturbances, as transmitted to the car body through the trucks under test. This deficiency should not be disregarded by the equipment engineers of the railroads and the manufacturers. It should be the subject of constant and active study for a positive determination of the adjustments necessary in the records, as presently made with soundly based instruments, or through some other approach, to accomplish the equating of these two values on a reliable basis.

With this knowledge at hand, no longer would it be

(*Continued on page* 14)

The Type S-1-L-P truck is identical with the Type S-1-L except for the use of pedestal type side frames

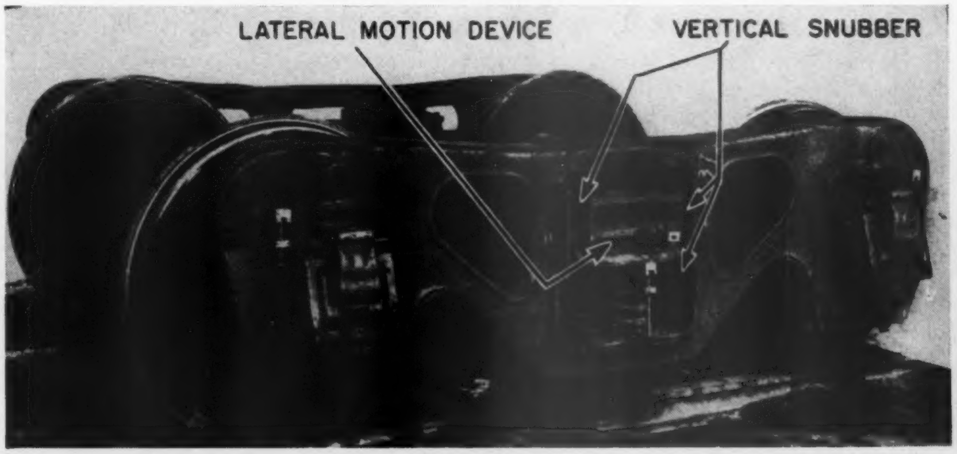


Fig. 1 (left)—Cab end of a Diesel locomotive badly damaged in a wreck. Without the use of welding it could not have been repaired. Fig. 2 (Right)—Damaged sections of the locomotive have been removed by oxyacetylene cutting torches preparatory to rebuilding

Diesel Locomotive

Maintenance Welding*

By R. L. Rex†

A description of some of the welding applications used in current Diesel-electric locomotive maintenance practices

THE increasing demand for Diesel-electric locomotives has led to a broader understanding of maintenance problems peculiar to the Diesel, a broader application of parts repair instead of more costly renewal, and a refinement of repair and maintenance techniques. Increased experience with Diesel maintenance is enabling increased utilization through careful planning and practice of scheduled preventive maintenance and operation.

It is the purpose of this paper to illustrate the particular emphasis of welding techniques and applications upon the refinement and extension of Diesel maintenance practice. Only a few of the more interesting types of maintenance welding can be described here. But current practice includes a wide variety of welding applications and promises even broader use of welding techniques as increasing numbers of Diesel locomotives go into service.

Rebuilding Diesel Engines

An excellent example of the employment of oxyacetylene and arc welding processes to Diesel locomotive maintenance on a major scale is their application to the repair of damaged locomotive bodies. Fig. 1 shows a locomotive body so seriously damaged that it appeared beyond repair. To replace it would have cost many thousands of dollars.

In addition, new parts required to make the repairs were not available. It was therefore necessary to make the parts required in order to put the locomotive back into operating condition. So the resourceful railroad people set about to quickly and effectively get the locomotive back into service. Without welding and cutting apparatus and techniques, this repair could not have been accomplished.

The bent beams, body ends and sheeting were removed by means of the oxyacetylene torch, leaving the locomotive stripped down to the base of the damaged sections, as shown in Fig. 2. New sections were made and arc-welded into place.

Where heavy stresses were apparent, the beams were reinforced by welding overlapping plates into position, covering the joints in the beams. Body beams and diagonal reinforcement angle were arc-welded into position.

The fuel tanks, which had been torn and bent, were straightened. The damaged sections were cut out and new ones welded into place. Other damaged parts, such as cabinets, draft gear, supporting frames, headlight, roller bearing journal boxes, electrical parts, body beams and anti-slewing devices, were all repaired and the locomotive put back into service in a short time, at a minimum expense, good as new, and without trace of the original damage.

* An abstract of a paper presented at the twenty-ninth annual meeting of the American Welding Society at Philadelphia on October 26, 1948.
† General Superintendent Railway Service, General Technical Sales Division, Air Reduction Sales Company.

Repair of Engine Bases

When Diesel equipment first came into railroad service, the lack of familiarity and experience with its maintenance led to many unnecessary expenditures for new replacement parts where effective repair could have been accomplished at a great saving. Diesel maintenance seemed shrouded in mystery in the face of maintenance practice on steam locomotives. But welding techniques soon became so important to economy in Diesel locomotive maintenance that the railroad people have learned to avoid replacement with new parts until every practicable effort has been made to accomplish effective repair.

There is the case of a major railroad which was faced with a considerable expenditure for replacement parts when three cast iron Diesel engine bases broke in rapid succession. Welding specialists were called in to determine whether they could be repaired. After inspecting the breaks, the welding specialists recommended oxyacetylene braze welding, which proved to provide a satisfactory solution.

In each case, the engine base fracture developed on the generator end, and extended up and across both sides of the oil compartment. Study of the fractures led to the following method of repair:

Each base was first chipped in preparation for braze welding. Then, to maintain alignment, an old axle was machined and fitted into the bearings. Using a preheating furnace constructed of fire brick, the bases were heated to about 900 deg. F. with a charcoal fire.

Fluxes were used in the braze welding operation, and 75 lb. of bronze welding rod were used on the three engine bases. Two welders worked simultaneously for about 12 hours on each base. Following the welding operation, each base received a post-heat treatment to avoid too rapid cooling. Fig. 3 shows one of the engine bases after welding and removal from the furnaces.

All three bases were soon back in service and functioning perfectly. Not only was the repair by braze welding quick, but it was effective and very economical. The railroad estimates that about $15,000 was saved by repairing the bases instead of replacing them.

Reclaiming Aluminum Pistons

A continuing problem in Diesel locomotive maintenance has been that of reclaiming aluminum pistons. Formerly, damaged or worn-out pistons were replaced by new ones. But increased experience with Diesel repair has shown that it is practical to repair such pistons by the application of welding processes, and at a very considerable saving over the cost of new pistons. Early practice in this field employed oxyacetylene welding, but this method is being largely replaced by arc welding processes.

Arc welding has been applied with considerable success by one railroad which formerly used new piston replacements instead of attempting repair. Trouble had been experienced with cracking across the top of the head of aluminum pistons used on Diesel switching locomotives, and in this instance new pistons were not available.

These pistons were 18 in. high, 12⅝ in. in diameter, and 2⅜ in. thick at the top of the head. In Fig. 4, the left piston has been repaired by arc welding, and the two on the right have been Vee-ed out in preparation for welding.

In preparing the pistons for welding, they were soaked in a carbon solvent. The crack in each was then chipped out, and the piston was preheated for welding, using a mild torch preheat of about 300 deg. to 400 deg. F. For the preheat and the welding operation, fire brick was built up around the piston, as shown in Fig. 5, to permit retention of heat. The success of this method has led to

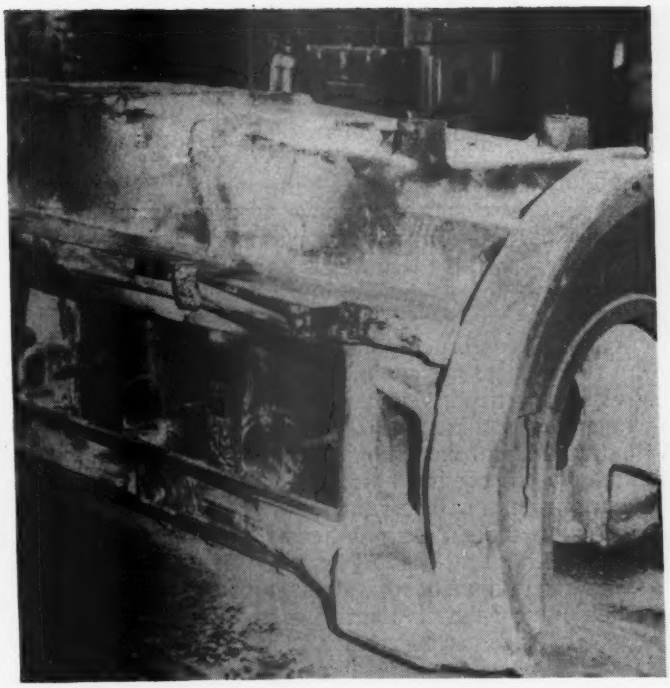


Fig. 3—Diesel-engine base after welding and removal from furnace

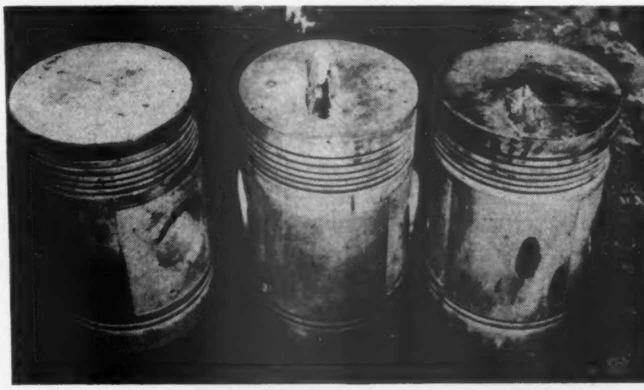


Fig. 4—Aluminum pistons which cracked across the top of the head. The one on the left has been repaired by arc welding. The other two have been Vee-ed out for welding

Fig. 5—Before arc-welding cracked aluminum pistons, a furnace of firebrick is built up around the piston to preheat it and maintain preheat temperature during the welding

the design of a container lined with asbestos for preheating the pistons.

Aluminum electrodes were used in the welding operation, best results being obtained by the use of a 1/4-in. rod. Experience accumulated on this job has brought about certain specific procedures. The arc is crowded as closely as possible and moved along quite rapidly, with the arc well up on the side of the groove. As each pass is made, the deposit is chipped, particularly along the edges, and all slag is carefully removed. After the weld is completed, the piston is covered and allowed to cool slowly.

Some of these pistons have been in service for a year or longer since repair. That is practically equal to new head service, and not one of the repaired heads has failed as yet. The repair welds have only 0.003 to 0.005-in. distortion, and as there is a 0.040-in. tolerance between the cylinder bore and the piston diameter, they are well within the limit. There is no distortion of the wrist pin holes.

New pistons of this type cost $170 each. Reclaiming them by the method described costs only about $15 each, including all labor, welding material and welding time.

A new development of some significance in the repair of aluminum pistons is the use of the inert gas-shielded arc welding process. Recently, a railroad experimented with this application, and although the piston used for the experiment had been prepared for gas welding instead of inert gas-shielded arc welding, the figures nevertheless give an interesting picture of the potential effectiveness of this application. Had the piston been prepared for the process used, instead of for gas welding, less filler metal would have been used, and the welding time would have been cut down considerably.

The piston used for this experiment had a 12 3/8-in. outside diameter and 20-5/16-in. overall length, and weighed 103 lb. A groove 4 1/4 in. wide and 1/4 in. deep was machined in the ring area. The entire cylinder was preheated with an oxyacteylene flame, using a multiple-flame torch tip at about 300 deg. F.

For the welding operation, alternating current in the 300 to 500 ampere range was employed. A 400-amp. industrial-type transformer welder with a spark-gap oscillator was the source of the current. Argon for the inert gas shield was used at a rate of about 15 to 18 cu. ft. per hr. The piston was placed lengthwise on ball bearing rollers, Fig. 6, to facilitate turning the piston while welding was in progress. By this means, distortion was minimized.

The entire welding operation utilized 12 lb. of drawn Silicon aluminum welding rods of 3/16-in. diameter. Build-up was accomplished by using a beading technique. Four layers were required to fill the depth of the groove. The first three layers took eight beads, while the last, or finishing layer, was made in 12 beads. Manual welding speed was about 6 to 8 in. per min. Fig. 7 shows the piston after completion of welding, but prior to machining.

Had the piston been correctly prepared for the process used, instead of for gas welding, it may be assumed that, based upon the speed mentioned above, and with allowance for incidental interruptions, the total welding time would have been approximately six to eight hours, with argon gas consumption of 125 to 150 cu. ft. per piston.

It is clear from this test that the inert gas-shielded arc process for aluminum piston repair will result in reduced maintenance costs if a sufficient amount of this kind of work is done to warrant the purchase of equipment for use of this process.

Welding Cast-Iron Cylinder Heads

An important phase of Diesel locomotive maintenance is the repair of cast-iron cylinder heads. Their failure usually occurs as a result of fracture and/or deep-recessed seats. The technique used in their repair depends upon how finished a job is desired.

One large railroad, like others using Diesel electric power, experienced difficulty with cast-iron cylinder heads cracking both at the turbulence chamber and across the bridge between the valve ports. Most railroads have either been scrapping these heads, or shipping them to out-

Fig. 6 (Left)—An aluminum piston which has been prepared for inert gas-shielded arc welding. Fig. 7 (Right)—An aluminum piston which has been prepared by inert gas-shielded arc welding and is ready for machining

side jobbers for welding, but this railroad has found its own shops can handle this job with great success by using the following procedure:

The fracture is entirely removed by grinding or chipping. The casting is then placed on firebrick at the bottom of the furnace, both for support to the bottom and to allow free circulation of flames in the furnace, as shown in Fig. 8. This furnace is about 36 in. by 40 in., and allows ample room between the casting and furnace walls. This space is then filled with charcoal and covered with sheet asbestos. The head is heated for about four hours. It is then slowly brought to an even cherry red by the use of two welding torches.

Fig. 9 illustrates the welding operation. It is important that it be performed only by a competent, experienced cast-iron welder, as the deposit must be dense and non-porous, and remain machinable. To obtain the result, ⅛-in. cast-iron rod is used with cast-iron flux and applied by oxyacetylene gas torches.

After welding, the casting is left in the fire and allowed to cool slowly. Ground asbestos is then packed in the furnace, covering both the live fire and the head. The cylinder head is then left to cool until the heat is completely dissipated from the casting. As this same asbestos is used time after time, it naturally gets filled with bits of unburned charcoal. This in turn ignites and tends to slow the cooling period to as much as five days. New asbestos requires less time to cool, and should be used where time is a factor. It is essential to the success of this welding procedure that the head not be removed until it has completely cooled. The casting may then be removed for machining. Fig. 10 shows the welded areas on heads on which the first machine cut has been made.

This maintenance operation alone has saved this railroad thousands of dollars, as total repair cost is only about $30, compared to the cost of $300 for the type of head shown in Fig. 10, and $180 for the type shown in Fig. 8. Also, the additional expense of shop tie-up time and shipment to a jobber is eliminated. None of the heads repaired by this procedure has failed to date.

Heads with Recessed Seats

The technique for reclaiming cylinder heads with deep-recessed seats and cracks is as follows: The affected areas are first machined so as to present new, clean surfaces for welding, and to provide greater space for weld metal. The affected areas are prepared by boring on a radial drill press or on a horizontal boring mill. If cracked, the cracks are removed by chipping and/or grinding. The valve stem bushings should be removed before preheating and welding.

The cylinder heads are then placed for preheating by either gas or charcoal, which can be supplemented by two heating torches. The heat is gradually bronght up to about 1,200 deg. F., and carbon plugs are placed in the valve ports to minimize the quantity of weld metal and to provide more uniformity in the hole finish for machining. Carbon plugs can also be placed in the fuel injection opening to prevent the molten metal from plugging that area.

The weld metal is then applied in the affected area, maintaining the recommended preheat temperature. Care must be taken in the fusing of the base and weld metal to ensure a fine grain structure and to eliminate porosity.

After the areas are built up, hot flaked asbestos (crushed boiler lagging) should be used to completely cover the head, using about three inches of covering. The head is then allowed to cool slowly, and every precaution is taken to protect it from cold air drafts. Under no conditions are the heads handled or exposed until they have completely cooled.

The heads are then ready for machining, which can be done on a radial drill press or a vertical boring mill. With proper heat control and welding technique, the cylinder head face will not warp more than .0015 in. to .002 in., and this can be corrected by machining. The job is completed by inserting new valve stem bushings.

Reclaiming Engine Valves

When seats or stems of Diesel engine valves become worn, they must be reclaimed or replaced. It has been found that these valves can be reclaimed and put back into service at a low cost, and giving from three to three and one-half times the service life of new valves. As a result, valve reclamation is standard practice on many roads.

An example of this improved service is the experience of one railroad which placed a reclaimed valve in service alongside of a standard new factory valve in the same cylinder head. Both valves were to be kept in service until one or the other required removal. After 15 months of continuous service, it became necessary to remove the standard valve, as it had become worn beyond the point of serviceability. It showed 1/16-in. wear on the seat face.

By contrast, the built-up, or reclaimed, valve showed less than .0005 in. wear.

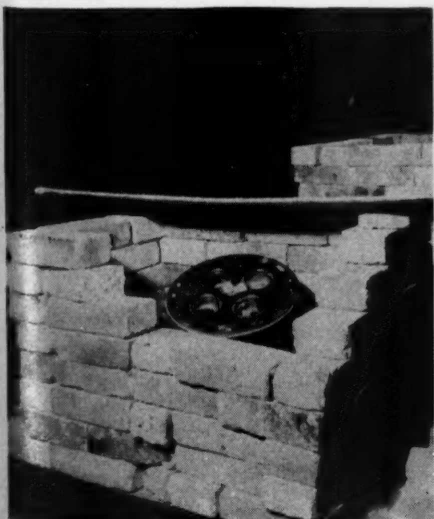


Fig. 8 (Left)—A furnace of firebrick is built up around a cast-iron cylinder head for preheat and welding operations. Fig. 9 (Center): A welder at work on a cast-iron cylinder head. Fig. 10 (Right): Cast-iron cylinder heads, showing the welded areas, on which the first machine cut has been made

Fig. 11—Two wheel-thrust end bearings for Diesel locomotives. The one on the right has been built up by welding and the one on the left has been machine-finished after welding

The valve seats in the head showed that the built-up valve had not affected the head seat, since both head seats were in about the same condition. The savings involved included not only 50 per cent of the cost of a new valve, but in addition the saving represented by extension of service life of the reclaimed valve.

Larger 4-in. and 5-1/4-in. diameter valves are reclaimed with even greater savings. They are thoroughly cleaned before the hard-facing alloy is applied. The flame is applied to the worn area, taking care to keep it deflected from the stem to prevent distortion. After the hardfacing material is applied, the valve is trued up by machining and the seat is also machined, after which it is finished by grinding.

In some cases, the valve stems become worn, and are reclaimed by metal spraying. The valve is set up in a lathe, and a cnt is made, reducing the stem about .025 in. in diameter, after which the surface is knurled and the metal sprayed on with an .80 carbon steel. Then, by grinding, the stem is restored to its original size. In the case of the larger valves, savings of as much as 80 per cent of the cost of a new valve are effected.

Reclaiming Wheel Thrust End Bearings

Deisel locomotive wheel and thrust bearings, which limit the lateral space between the end of the axle and roller bearing boxes are faced with a bronze bearing metal. As the bronze becomes worn, lateral tolerance becomes greater and must be corrected elther by replacement with new thrust-bearings or by renewing the bronze bearing surfaces to bring them back to standard. The thrust bearings are 4-5/8 in. thick, when new, and must be replaced when they become worn to 4-1/8 in. thickness.

A simple and common method of restoring them is by use of the arc welding process with lead bronze electrodes. In preparing a thrust-bearing for welding, a carbon disc is inserted in the speedometer cable hole of the thrust bearing casting, after which the bearing surface is built up with the lead bronze electrode. The process requires three passes and consumes four 1/4-in. electrodes per pass, or a total of twelve electrodes. The carbon discs are then removed, and the bearing surfaces are finished in a lathe, after which the oil hole is drilled, and the oil slot cut on a shaper.

The original cost of these bearings is $16.40 each, and they can be reclaimed for 35 per cent of the cost of new ones. Build-up time is 20 min. for each bearing, and total machining time is 40 min. Fig. 11 shows a built-up bearing on the right, and a machine-finished bearing after welding on the left.

Journal-Box Wear Plates

A constant maintenance factor in Deisel locomotive operation is the replacement of roller-bearing journal-box wear plates. Their surfaces become worn from constant sliding action on the truck pedestal jaw plates, and they have to be replaced by welding new wear plates to the roller bearing journal box. Since the wear plates are of high manganese steel composition, and the boxes of low carbon-composition, the use of ordinary electrodes would produce under-bead cracking of the weld. Therefore, the following procedure has become standard practice.

The old wear plates are removed by either chipping or grinding, after which the new liners are welded into place, using lime-type stainless-steel electrodes. Fig. 12 shows a welder at work applying new liners. Before welding, the bearing openings are first covered to protect the precision, high-finished roller bearings from possible spatter and damage.

Other Typical Welding Applications

Lube and fuel oil tanks	Bolsters	Roof and hatches
Traction motor gear cases	Underframes	False ceilings
Underframe side bearings	Ballast	Carbody bolsters
Air reservoir brackets	End plates	Coupler pockets
Platforms, front and rear	Floor plates	Battery boxes
Side and front framing	Frog hooks	Spring holders
End sheets—air ducts	Base angles	Cross bearers
Engine and generator pads	Pipe clamps	Spring planks
Push pole pockets	Water tanks	Truck frames
Fuel tank supports	Sand boxes	Steps and skirts

Conclusion

The growing emphasis on welding applications and techniques in the maintenance of Deisel locomotives stems from the necessity to compensate for the higher initial cost of this type of power, and from the rapidly increasing demand for Diesel power in preference to other types. The increasing demand for Deisel equipment not only has broadened the scope of maintenance repair and reclamation practice in lieu of new part replacement, but directly reflects the ability of efficient maintenance methods to compensate for the higher cost of such equipment.

Welding techniques and practice in the field of Diesel locomotive maintenance will be still further extended as more of this type of equipment goes into service and greater experience is gained in the maintenance problems characteristic of it. One of the more important new welding techniques which may be expected to contribute materially to increased maintenance economies is that of the inert gas-shielded arc welding process.

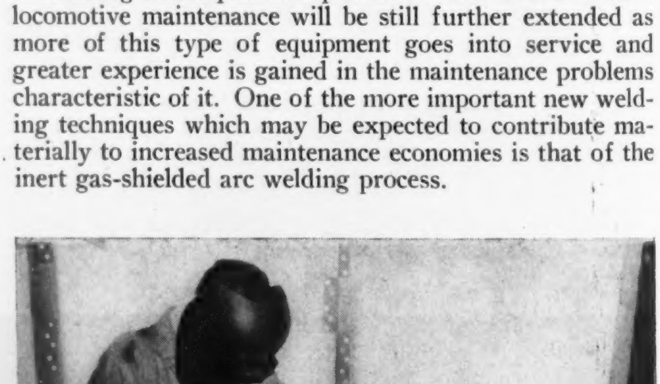


Fig. 12—New wear plates of high-manganese steel composition being welded into place on the roller-bearing journal box of a Diesel locomotive

The Coal Burning

Gas-Turbine Locomotive*

By C. K. Steins,†

THE coal-burning gas-turbine locomotive project contemplates the building of a 4,200-hp. locomotive by the American Locomotive Company using an Allis-Chalmers gas turbine, and a 3,750-hp. Baldwin locomotive using an Elliott gas turbine. The two locomotives are one project and the development work is being carried on by the Locomotive Development Committee of Bituminous Coal Research, Inc., a group composed of nine large railroad companies and four of your member coal companies. R. B. White, president of the Baltimore & Ohio, is the chairman of this group, and J. I. Yellott is director of research. The work is now in its fourth year.

The concept of the gas turbine is not new. John Barber in 1791 was issued a patent on the basic features of the gas turbine and other inventors have taken out patents up into the early part of the twentieth century, but the hurdles of efficient compressors and suitable metals were always present. During this period the reciprocating steam engine, the steam turbine, and the Diesel engine advanced rapidly and entrenched themselves as prime movers in the fields for which they were best suited.

The appeal of the gas-turbine power plant lies mainly in the fact that essentially it is a simple machine, requiring no boiler, boiler water, water treatment, condenser, or other parasitic apparatus, and no reciprocating machinery is involved. The gas-turbine power plant uses a compressor to deliver large quantities of air to a combustion chamber where fuel is mixed with the air and burned. These products of combustion are directed into the balding of a turbine not essentially different from a steam turbine.

As thes gases pass through the turbine blading, they expand and cause the turbine to rotate. A great deal of work has to be done by the compressor to compress the enormous quantity of air required to burn the fuel with which it mixes in the combustion chamber, air not only sufficient to burn the fuel but eight or ten times more to keep the gases down to a temperature which the combustion chamber material and the turbine blade material can stand. With so large an amount of work to be done by the compressor, it will be appreciated that unless the job is done efficiently, the gas turbine has about all it can do. Merely to drive the compressor which is coupled to its shaft, and no net power, or only a small amount, will remain for useful work. An efficient gas turbine layout as the art has advanced up to the present will have a turbine putting out four units of work and, of these, roughly three units will be used up by the compressor and other losses. Very close to one unit remains for the useful work of driving a generator or other form of power take-off. The coal-fired, gas-turbine locomotive with electric transmission is expected to produce 20 hp. at the rail for every 100 hp. of heat energy in the coal. Expressed in the usual way, the locomotive's thermal efficiency will be 20 per cent. This compares with 26 per cent for the Diesel-electric and 5½ to 6 per cent for the modern steam locomotive. The term "electric transmission" is used as this is a simple conception of the function of the generator and traction motors on a locomotive which carries its own prime mover. Another conception, equally correct, is that these locomotives carry their own electric generating station.

One of the most efficient forms of compressors is the axial flow type. This was brought out commercially about 1901 and it has been improved until its efficiency is now around 85 per cent. Enormous strides have been made in the development of heat-resisting materials, particularly immediately before and during World War II, and it is this combined progress in compressor efficiency and materials that has put the gas turbine in the forefront of prime mover thinking. Atomic energy is unlikely to push the gas turbine aside as atomic energy, when it comes into commercial use, will probably be in the form of heat, and that clean heat looks promising as a means for producing hot gases for a gas turbine. The coal industry need not be concerned about this for some time to come.

The Locomtive Development Committee was given the task of designing and building a gas-turbine plant that would use coal as its fuel and be suitable for mounting on a locomotive chassis. There were the powerful reasons for specifying that coal be used: first, a million B.t.u. of coal cost 20 cents today as against 90 cents for the same amount of energy in Diesel fuel and, second, we have an abundance of coal in this country. Even if a low grade liquid fuel—i.e., one containing 1½ to 2 per cent ash—can be burned successfully in a gas turbine, we would pay 60 cents for a million B.t.u. which still leaves coal in a favorable position. Widely divergent statistics have been published about our oil reserves and there is some doubt as to just what the true situations is, but I do not think there is much question that, in a national emergency, fuel oil for locomotive use would quite likely be in short supply.

It would not have been necessary to set up a group to progress the development of a gas-turbine locomotive to burn liquid fuel. The gas-turbine principle is attractive enough to engineers in its own right to provide the incentive for such a development. That this incentive exists is evidenced by the fact that today several large companies are making splendid progress in developing liquid fuel gas turbine prime movers for locomotive use and one such locomotive is already on order by the Atchison, Topeka & Santa Fe.

The coal-burning gas turbine, however, is quite another thing from one burning liquid fuel, and to say that it is an exceedingly tough nut to crack is no exaggeration. I shall be careful in these remarks to avoid saying anything that will give you the impression that the solution of this problem is immediately at hand. Many developments are merely the assembly of proved parts into a workable combination but not so the coal-burning gas turbine. Let us consider the key problem in this project.

†An address delivered before the National Coal Association at New York on October 5, 1948.

*Mechanical Engineer, Pennsylvania.

First, a coal bunker will be carried on the locomotive for run-of-mine coal with a crusher to break up the large lumps to minus 2 in. size. The hopper of this bunker will be arranged with heating means to reduce the moisture content of the coal to not over 5 per cent. A stoker type conveyor will then carry the dry coal to a preliminary crusher. These steps are simple and, of course, there is a good deal of precedent to guide the designers.

Second, we must have a preliminary crusher to get the coal down to about minus 16 mesh size. This is about the size of granulated sugar. This is nowhere near the final size required and in some manner we must get it down to where not less than 90 per cent will pass through a 200 mesh sieve and a large percentage of this through a 325 mesh sieve, that is, about the size of flour. When you consider that these particles must be completely burned in the combustion chamber in about two-tenths of a second, the need for microscopic particle size is apparent. The preliminary crusher just mentioned might also be the final crusher and that may eventually be the solution, but such a crusher would be so large that it would be difficult to find room for it on the locomotive and the power to drive it would be in the order of 200 hp., and that, of course, would be a deduct from the power available for hauling the train.

Let us assume in this discussion that we will only grind the coal to granulated sugar size in our preliminary crusher so that does not take too much power, and that the final minute size will be got by some other means. We have been trying to get this final size by picking up the particles in a fast-moving stream of air and smashing them against a target of highly erosion-resistant material. The particles will be traveling at about 700 miles per hour when they hit.

I passed rather quickly over the problem of getting the particles in this fast-moving stream of air. This has been a pioneering effort of no small proportions. No device is available on the market to do this, but there was an idea of a rotating cylinder with pockets in the periphery, the pockets being filled by gravity as they pass under the hopper of a small bin filled with the granulated-sugar-size coal. Something like a Ferris wheel, except that people do not drop into the cars at the top and get shoved out by a stream of air at 160 lb. gauge pressure at the bottom. That, however, is the idea we are working on for pressurizing the coal. Unless we have the coal under slightly higher pressure than the air being delivered to the combustion chamber by the compressor, we simply cannot get the coal into the combustor to be burned. The coal-laden pockets rotate to the bottom where the stream of air at right angles to the wheel cleans out the pockets and carries the coal along to the target for its final pulverization. If this wheel rotated at infinitely high speed, we would have the idea of condition of a continuous flow of coal into the combustion chamber, but the wheel can be rotated at a sufficiently high speed to give for all practical purposes a continuous flow. The means for governing the amount of coal that dorps into these pockets becomes the locomotive throttle. I need hardly tell you that it is no small problem to design such a pocketed wheel with machine clearances in the order of four one-thousandths of an inch, but that is the kind of machine tolerance needed to prevent the air at 160 lb. pressure in the target line from flowing back along the sides and around the periphery of the wheel into the small gravity bin and stopping coal delivery. The side faces of this wheel will rotate against seals which must have long service life. We had a number of failures in building these wheels, but a recently designed one has given a good performance after 50 hours of testing. We realize, however, that this is a relatively short time from the standpoint of locomotive use and we, therefore, cannot assume that we are out of the woods.

I will not take time to describe in detail the target against which the coal is smashed to get it down to final size. I might say that, in our early thinking, it was felt that the degradation of the coal in this apparatus resulted from filling the coal pores with high-pressure air and that, when the pressure was suddenly relieved by passing through the orifice into an atmosphere of lower pressure, the air trapped in the pores exploded the coal in much the same manner that puffed-wheat cereal is made. Research has shown that there is little, if anything, in this theory and that the degradation really results from smashing the coal against the target. It is interesting to note, in connection with this target, that some of the hardest known materials have been gutted out by the impact of the coal particles after only a few minutes of operation. Targets made of cast tungsten carbide are now giving good results. It begins to look now as if one target is not enough, that a few coarse particles bounce off, and that these coarse ones will have to be got out of the stream by centrifugal action and smashed against a second target. This is the sort of thing that our research group runs into as they go along, and such problems made a timetable very difficult to live up to.

The coal, after leaving the targets, is down to what we will call flour size. It is then ready to be directed into the combustion chamber and mixed with the compressed air and burned. The combustion chamber has been, and still is, a major problem. We are carrying on development work at the Kaiser steel plant at Fontana, Calif., this being the only place in the country where there is available a sufficient quantity of compressed air for full-scale expermentation. Combustor development is also going on at Battelle in Columbus, Ohio, and the Alco Products plant at Dunkirk, N. Y. It looks now like the combustor will be a stainless-steel tube about 127 in. long by 25 in. mean diameter, with telescopic sections, the whole encased in a tube into which the air for combustion and cooling is delivered. One of these combustors will supply enough gases for the Allis-Chalmers turbine, but the Elliott will need two in parallel because it is designed to operate on a lower pressure and temperature. The pulverized coal is given a swirling motion as it enters the combustion tubes and the air for combustion and cooling enters this tube through holes and annular slots between the sections.

Consider, if you will, that in the case of the Allis-Chalmers single-combustion chamber coal will be burned at the rate of 70 to 80 lb. per min. at full load depending upon the B.t.u. value of the coal, and that 21,000 cu. ft. of air at 60 lb. pressure, 640 deg. F., must pass into the tube very minute for combustion and cooling and that these products of combustion will emerge from the exit end of the tube in the order of 34,000 cu. ft. per min. at 1,300 deg. F. You will see from this that the residence time of each particle of coal in the 10-ft. tube is less than two-tenths of a second, as I have already stated, during which time it must be completely consumed. Its ash, while it is still in a molten state, must not be permitted to impinge against any part of the tube and stick there. It is interesting to compare this combustion problem with its heat release of a million and a half B.t.u. per cu. ft. per hr. with the heat release in the firebox of a modern pulverized coal central station boiler where the heat release is in the order of 30,000 B.t.u.'s per cu. ft. per hr. This problem arises

(*Continued on page* 14)

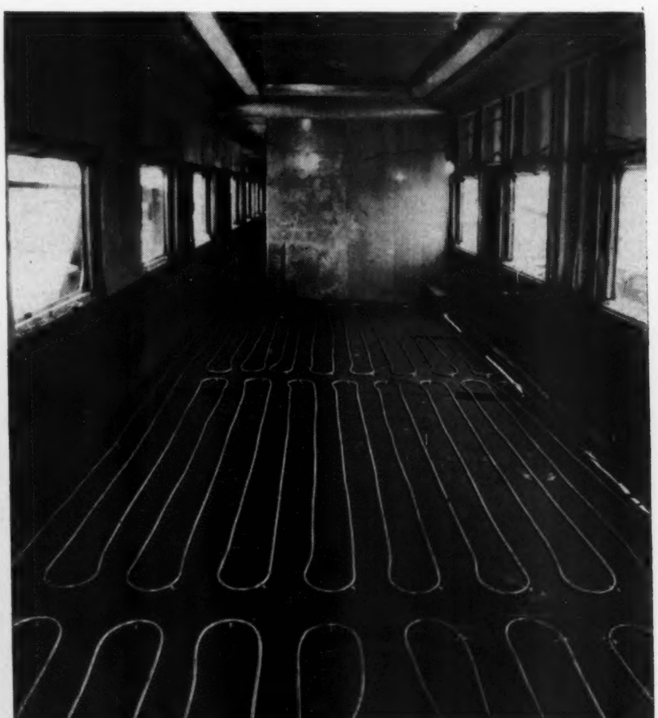
Radiant Heat in Mexican Car

Installation in the private car of President Aleman of Mexico involves use of radiators of copper tubing laid in mastic floor of the car

An interesting installation of the use of radiant heating is that of a private car built for the Mexican government and used by President Aleman. The 70-foot car has five bedrooms, a galley and a lounge opening on an observation platform.

The heating medium is hot water distributed from a heat-generating unit enclosed in an insulated steel box suspended below the car. This is 5 ft. 6 in. in length, 32 in. deep from the side of the car and approximately the same depth below the car floor. The radiators consist of ⅜-in. copper tubes laid above the main floor structure and imbedded in a 1¼-in. coat of mastic. The finished surface of the floor consists of a ¼-in. thickness of sponge rubber, over which is laid a broadloom carpet.

The under floor consists of a ¼-in. steel plate; on this is laid a floor of oak boards 1¼ in. in thickness. On the oak floor is placed a corrugated zinc sheet, the corrugations of which are approximately on 1-in. centers. The copper-tube radiators are separated from the zinc by a layer of building paper.



The mechanical equipment for heating and circulating the water consists of a steel storage tank, 22 in. in diameter by 43 in. long, in which are inserted two Bell & Gossett heat exchangers. Steam from the locomotive passes to one of the heat exchangers through a Fulton Sylphon pressure-reducing valve, thus heating the water in the tank to 180 deg. F. The condensate is collected in a steam trap and wasted. The water temperature is automatically controlled. Through the other heat exchanger cold water from the car water supply is passed and heated for use in the kitchen, showers and lavatories. A Fulton Sylphon thermostatic mixing valve is employed to control the water temperature.

Hot water for the heating system is drawn directly from the tank at 180 deg. and circulated by means of a small centrifugal pump, motor-operated on 32-volt d.c. current, which is inserted in the water line on the return side of the hot-water tank. This hot water is circulated from a manifold through eight risers to as many floor radiators, thence passing upward from the ends of the coils through tubes in the side wall of the car.

In the space above the ceiling the ⅜-in. lines lead into a return pipe to an expansion tank and a return main which passes down through the side wall to the unit under the car. The expansion tank is fitted with an air vent valve. In the return riser from each radiator in the small rooms is a ½-in. Fulton Sylphon thermostatic radiator valve by which the flow of water through the radiator is controlled. At the lounge end of the car the return lines from all three coils join in a riser in which is a single thermostatic control valve.

A by-pass is provided between the return main and the hot-water supply line to the heating system so that

Above: Copper-tube radiators in place, ready for application of the mastic flooring—Right: Heat exchange equipment, circulating pump, and controls are installed under the car

the temperature of the water entering the floor coils may be reduced below the temperature carried in the tank when weather conditions make this desirable. The amount of return water by-passed is determined manually.

The radiator coils aggregate approximately 900 lineal feet of copper tubing. The heat-exchange capacity of the system is 317 gal. per hr. at a temperature rise of 140 deg. with steam at a pressure of 50 lb. per sq. in. The capacity of the hot-water supply for kitchen and room use is 152 gal. per hr. at a temperature rise of 100 deg., the heater being immersed in water at a temperature of 180 deg. F.

This car, which was completed during the past summer, was built by the Ransome Company, Emeryville, Calif., and is the first of several, including sleeping cars, dining cars, and coaches, to have similar radiant-heating installations which the Mexican government plans to purchase.

Pacemaker Box Cars

(*Continued from page* 5)

necessary to rely on speculation with respect to the relative importance of lateral vs. vertical shocks of freight-car operation, and to leave unanswered the question of which of these two lading- and equipment-disturbing influences may be most in need of reduction in a given case for a closer approach to shock-free movement of freight trains, especially for those operating on high-speed schedules.

In the use of companion test cars equipped with accelerometer type instruments, little or no opportunity has been afforded to accumulate in the results to be studied the recorded relative magnitudes and characteristics of longitudinal disturbances and shocks. Instruments designed to obtain such data should be made available for use in trains of some length when made up in whole or in part, of cars having improved features for the establishment of comparative evaluations of lateral, vertical, and longitudinal force reactions. These three reactions should be simultaneously recorded in such cars and in those with which their performances are to be compared.

For longitudinal action, it is probable that the peaks would be found of more importance than the total counts, but this would be subject to comprehensive judgment from the breakdown of the gravity-value counts recorded in each car undergoing check. This would require instruments of size and weight permitting reasonably convenient portability.

For years there has been a crying need for such measuring equipment and, after much discouraging experience with the instrument makers and others in efforts to have it designed and developed, our engineers, themselves, produced a set of handmade accelerometers which, from experience to date, have demonstrated the embodiment of the required fundamental characteristics. These particular instruments are arranged for passenger-car recording and in that service have successfully produced, over tangents and curves, reliable and continuous records of the kind desired. The measuring portion is divided into two units, one to register the vertical accelerations and, the other, a horizontal unit, to record in both directions either lateral or longitudinal accelerations, depending upon the position in which it is placed. There appears to be no reason why the same, or equivalent, equipment adjusted for the accelerations of freight-car movement, cannot be produced. The rate of progress in both passenger and freight operations can be ascertained only on the basis of sound and comprehensive instrumentation.

Gas Turbine Locomotive

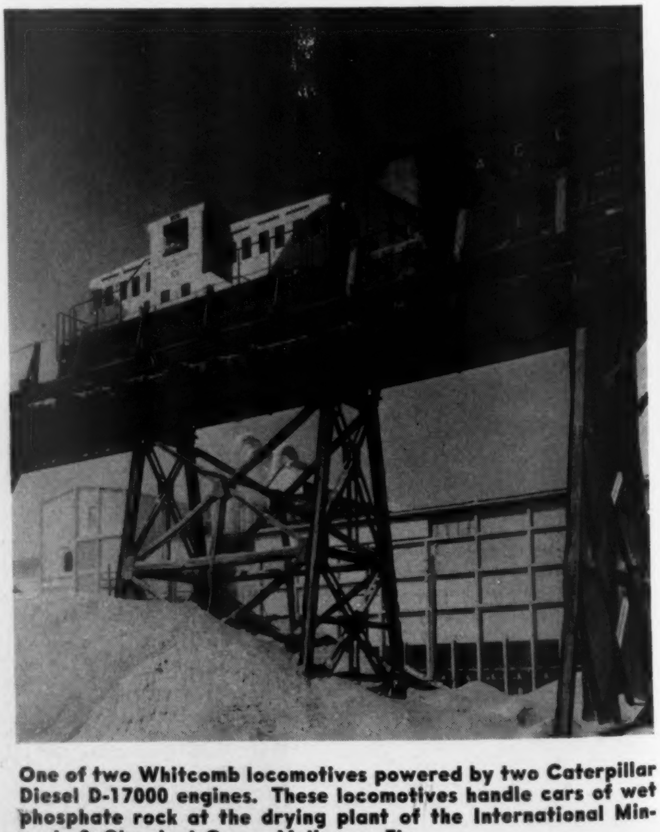
(*Continued from page* 12)

from the fact that when you are building a locomotive, you must keep it within standard railroad clearances. It is obviously economically impossible to do anything about this.

Lastly, there is the problem of cleaning the products of combustion after they leave the combustor. Dirty gases cannot be directed against turbine blades at a speed of some 400 miles per hour. They would cut them to pieces. While there is evidence that particles as fine that they give only a slight haze to the exhaust—i.e., under 20 microns diameter—will not harm the turbine blading, we know there are large particles as well as small ones leaving the combustor and these large ones will have to be got out with a minimum of penalty in the form of pressure drop. After several months of work we felt that a battery of small cyclone separators was the answer to cleaning the combustion gases and that this part of the research was behind us, but on recent long-time tests at Dunkirk it was found that some burning went on in these tubes and this was enough to ruin them. There are now being developed two designs of cleaners, both of which appear to have possibilities, and we are hopeful that one or both of them will give the degrees of clean gas that the turbine can handle without being damaged. The big particles of ash that will be taken out can be collected in a small container and carried along to the locomotive terminal.

You will see from this brief resume of the project that the coal-burning gas-turbine locomotive is not just around the corner; that much hard work has been done, and much remains to be done before this completely new type of railroad motive power is on the rails.

* * *



One of two Whitcomb locomotives powered by two Caterpillar Diesel D-17000 engines. These locomotives handle cars of wet phosphate rock at the drying plant of the International Minerals & Chemical Corp., Mulberry, Fla.

Maintenance of Steam Power*

By C. B. Hitch†

The modern steam locomotive presents a considerably different maintenance problem than did locomotives built as late as 20 years ago because of many such items as the general increase in the over-all size and power of locomotives, the cast bed, roller bearings, improved feedwater heaters, injectors and pumps, air brake equipment, mechanical lubrication, and poppet valves. There have also been changes in the materials used in locomotive construction, which have affected the maintenance problem, such as the introduction of high-grade alloys for boiler steel, forgings and castings.

Many of these have increased maintenance cost. The increase in size of locomotives has increased the weight of parts to be handled in the shops and enginehouses, new appliances have resulted in increased complication, and improved materials, in many cases, require special practices and equipment for heat treatment.

On the other hand, a great number of the changes made in the past 20 years have reduced maintenance cost. The solid cast bed has eliminated practically all splices, joints and fitted bolts in the frame and cylinders, roller bearings have greatly reduced the labor and time required to service locomotives at terminals, and mechanical force-feed lubrication has greatly reduced wear and increased the life of such parts. Such improvements as these have resulted in an increase in the mileage run by locomotives between shoppings, with a consequent improvement in availability.

There are many other changes, external to the locomotive itself, which have reduced maintenance cost and increased availability. These include the use of treated water in boilers, which has greatly increased the life of flues and fireboxes and reduced pitting of boiler shells, portable crane trucks and similar material handling equipment which has speeded up the handling of locomotive parts in enginehouses and shops; also improved machine tools which increase shop output and improve the quality of the work.

The net result has been a general improvement in the efficiency of locomotive maintenance. There is, however, much yet to be done if we are to hold maintenance cost within reason in the face of increasing labor and material costs.

The problem of locomotive maintenance may be divided into three principal parts, as follows: (1) The facilities available, such as shops, roundhouses, inspection pits, drop pits, etc.; (2) the equipment available, such as machine tools, cranes, hoists, drop tables, small tools, etc.; (3) the practices and methods of handling the work, such as shopping schedules, standard and special instructions covering shop practice, material routing through the shop, etc.

The facilities required will depend, of course, on the amount and kind of work to be done. The arrangement and relative location of repair facilities should be given careful study, as it has an important effect on the efficiency of the whole operation.

The demand and the development of the modern steam locomotive has had a profound effect on the equipment used in locomotive maintenance. Present day requirements for increased availability and greater shop output can only be met by taking advantage of the up-to-date developments in shop equipment, particularly in the larger shops. These include high speed machine tools, the use of cemented carbide tool bits, automatic machinery such as turret lathes, screw machines, forging machines and improved welding and cutting equipment, both gas and electric.

It has been found good practice in cases where a machine tool or similar piece of equipment must be replaced at a relatively small shop or roundhouse, to purchase a modern high production machine for the main shop and transfer the second-hand machine from the main shop to the smaller point. In this way the smaller outlying points are furnished adequate equipment, and the equipment in the large production shop is continually modernized and the new machine placed where better advantage can be taken of its greater capacity.

The increased size and weight of the modern locomotive and its component parts has necessitated the use of improved equipment for handling these parts. Such devices as electric drop tables and engine hoists for wheeling and unwheeling in place of the older hydraulic jacks, electric and air hoists for handling parts in roundhouses and back shops and portable power cranes and lift trucks for handling material between the various departments in the plant. The purchase and use of such equipment should be given careful study, as it can have a considerable effect on the efficiency of the operation. Much time and labor can be wasted if proper and adequate equipment is not provided for this purpose.

The adoption of such improvements as roller bearings, poppet valves and alloy steels in modern locomotive design has necessitated the use of such special equipment in the repair shop. In this connection I might mention precision grinders, pressure rolls for crank pins and axles, special gauges and special heat treating furnaces and quenching baths, all of which are relatively new in locomotive repair work. There has also been developed improved devices for electric and gas welding and cutting, such as the automatic electric welder for building up parts, and the oxygraph machine for cutting out plates and forgings to template or drawing. The new flame-hardening torch is being used generally on such parts as guides, buffer castings and pedestal jaws. All of this equipment is costly, but is necessary to meet modern maintenance requirements.

Shop practices and methods of handling the work have as great, or greater, effect on the cost of locomotive maintenance as do the shop facilities and equipment used, and it is in this field that shop management has a chance to accomplish the most by careful planning and supervision. Proper scheduling of the work is particularly important, both to allow the most efficient use of manpower and to insure an adequate supply of material when needed. It is also important to have well planned standard shop practices in effect to govern

* Abstract of an address presented before the Locomotive Maintenance Officers' Association, at the Annual meeting in Chicago, September, 1948.
† Chief Mechanical Officer, Chesapeake & Ohio.

most operations so as to insure quality and uniformity of workmanship.

Scheduling Helps Reduce Shop Time

As an aid to scheduling classified repairs, it has been found advantageous to establish an assigned mileage for each class of locomotive. This mileage is based on the average mileage which each class of locomotive will make between general repairs, as determined by actual experience over a sufficient length of time to give accurate results. It will vary considerably, depending on the class of locomotive, and, to some extent, the service in which the locomotive is used. Here we notice a considerable difference between the modern locomotive and those of older design. For instance, many of the older locomotives with a few or none of the modern improvements will have an assigned mileage as low as 90,000 or 100,000 miles, while a modern locomotive with cast bed, roller bearings and other improvements, in high speed service, will make from 300,000 to 400,000 miles between general repairs.

Experience on at least one Class I railroad has demonstrated that a successful method of scheduling classified repairs is to consider the assigned mileage of each class of locomotive in connection with a forecast of the amount of business to be handled, broken down into the number of locomotive miles to be made by each class, usually one year in advance. In this case, the total mileage to be made by each class is divided by the assigned mileage to give the approximate number of general repairs to be made during the year. With this information as a basis, a detailed shopping schedule is made up for three months in advance.

This schedule takes into account the actual physical condition of the locomotives shown on the tentative schedule. No locomotive is shopped without first being inspected to determine its condition and the major items of material which will be required. In some cases locomotives can be set back on the schedule well beyond their assigned mileage. In other cases they must be shopped short of their assigned mileage due to accidents or other local conditions. However, the assigned mileage, together with the forecast of business to be handled, gives a fairly accurate picture of the amount of classified repair work to be done.

In some slow-speed services, such as transfer and yard switching, the locomotives will not run out their assigned mileage before becoming due for renewal of flues. In such a case, the time of general repairs is fixed by federal requirements, and most of the classified repair work is done on intermediate repairs.

The efficient handling of running repairs presents a different problem. It has been found advantageous to concentrate as much of the work as possible at the time of the periodical inspections required by the I.C.C. Bureau of Locomotive Inspection.

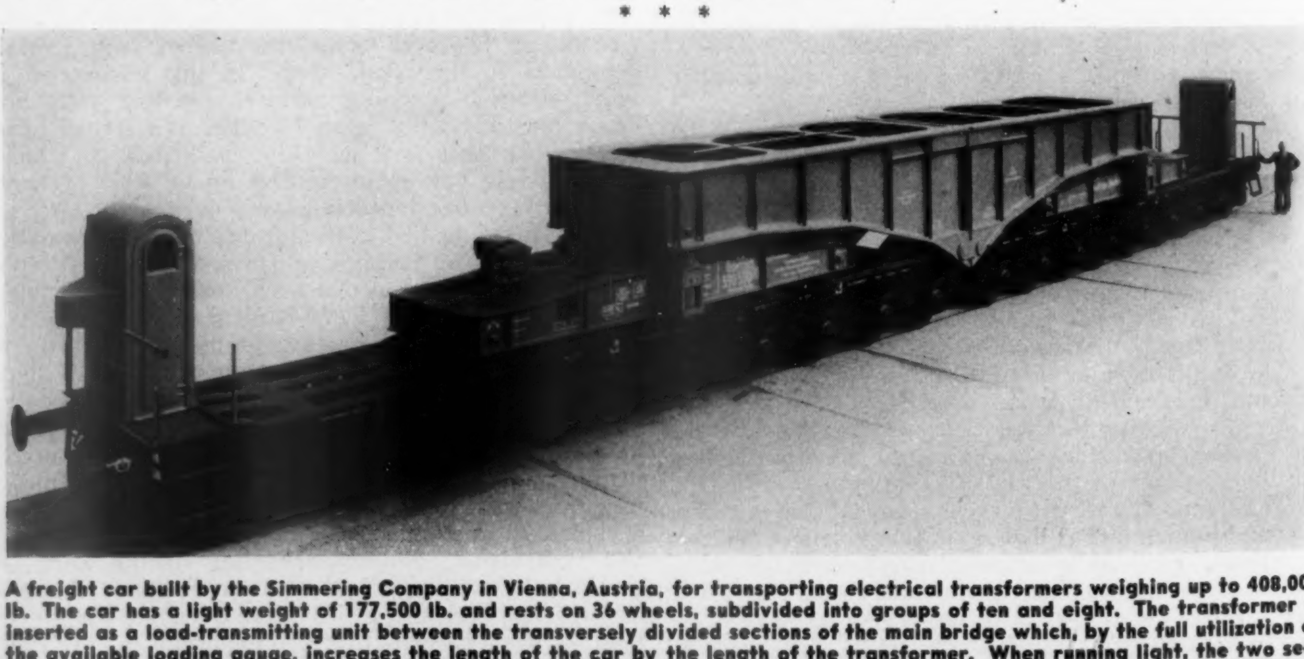
It is well to have in effect standard shop practices to cover each class of repair and each class of inspection made on running repair, listing all of the principal items to be taken care of in each case. The intelligent use of such standard practices insures that the work is carried out in an orderly manner, promotes efficiency, reduces maintenance cost and improves availability.

Personnel Training Is Important

Probably the most important point in connection with this whole subject is the training of shop personnel. Modern locomotive maintenance requires a considerably higher degree of skill and a broader technical knowledge than has been necessary in the past, and such skill and knowledge can only be gained by proper instruction and adequate experience. I think you will all agree that there is a shortage of properly qualified mechanics in railroad work in this country today, and that in many localities such men are practically unobtainable. This means that the shortage must be made up by training new men.

Training apprentices today is a different problem than it was 20 years ago. The ground to be covered is considerably broader in practically all crafts, and it has become more difficult in many localities to obtain the right kind of boy for the work, due to the inducements offered by other industries. However, there have been new methods of instruction developed since the beginning of the war by which complex mechanical subjects can be taught in the shortest possible time to anyone with reasonable intelligence. Many of these methods are applicable to railroad apprentice training. Full advantage must be taken of the latest and best training methods if we are to insure an adequate supply of skilled labor needed to maintain the modern steam locomotive.

* * *



A freight car built by the Simmering Company in Vienna, Austria, for transporting electrical transformers weighing up to 408,000 lb. The car has a light weight of 177,500 lb. and rests on 36 wheels, subdivided into groups of ten and eight. The transformer is inserted as a load-transmitting unit between the transversely divided sections of the main bridge which, by the full utilization of the available loading gauge, increases the length of the car by the length of the transformer. When running light, the two sections are connected by heavy links and bolts. Without transformer, the car is 120 ft. long. It can negotiate 20-deg. curves

EDITORIALS

The Mechanical Department's Role in Procuring Better Coal

A good deal of food for thought for mechanical-department men whose duties include locomotive operation was contained in a paper presented before the Railway Fuel & Traveling Engineer's Association entitled, "Mining and Preparation of Coal for Locomotives," as a part of a symposium, abstracted on pages 77 to 83, inclusive, of the November, 1948, issue. One statement made by the author of this paper, E. C. Payne, consulting engineer of the Pittsburgh Consolidation Coal Company, stands out in particular as a guide for mechanical men in determining their role in the selection of coal for most effective locomotive operation. The statements referred to replied to an opinion that railroads should learn from coal producers what sizes are available and then be careful in railroad specifications not to come into competition for sizes in demand by consumers other than railroads. Mr. Payne's reply was that railroads need not worry about other large consumers whose plants have the flexibility necessary to burn any of the fuel which the railroads won't burn, and that the steam locomotive should not subsidize the coal business.

Railroad mechanical men have long known the adverse effects on both operation and maintenance that result from the steam locomotive subsidizing the coal business by burning left-over grades of coal because the high combustion rate, limited ash-pan capacity and numerous other factors make the locomotive firebox the world's worst place to burn poor coal. Their knowledge of operation and design puts them in the best position to know when a locomotive is not performing as it should and when coal is an important factor in causing substandard performance. Because of their experience and training they are best qualified to determine the methods by which different kinds of coal may be compared, and to evaluate the results with respect to performance and the cost of operation.

Where the type of coal required for good operation at low cost is not known the first duty of the mechanical department is to find out what grade is needed. The fuel problem is big enough and expenditures for fuel great enough to justify a sizeable outlay of both time and money to gain this information.

But finding the answer is not the mechanical man's only responsibility. It is also his duty to present the facts to those responsible for the purchase of coal in such a way that they can know and understand how the best interests of the railroads can be served by purchasing the type of coal found by actual test to be the most economical when all factors including price, are considered.

Boiler Washing

For several years the boilermakers have recognized that large high-pressure locomotive boilers should be handled with care during cooling-down and firing-up periods to avoid setting up destructive stresses due to contraction and expansion. Although this fact has been discussed at meetings of the Master Boiler Makers' Association there has been no general acceptance of a procedure that would avoid introducing harmful stresses at washout time. As a matter of fact the boilermakers, as a group, suddenly realized only recently that some of the current handling of locomotive boilers seems to fit rather closely the requirements for their destruction. For that reason they are now showing a great deal of interest in the cool-down system of washing boilers.

There is nothing novel about the cool-down system. It is merely a boiler washing procedure for changing gradually the temperature of the boiler; the idea was discussed years ago at meetings of the old Master Mechanics Association. In general the cool-down system involves forcing water into the boiler with the injector until the injector breaks and then pumping water from the enginehouse line through the boiler, a procedure that slowly lowers both the pressure and the temperature.

It is perhaps somewhat ironical that advances in boiler design and maintenance practices have created conditions which make the avoidance of abrupt temperature changes in the locomotive boiler more important. Both the greater size of modern boilers and the higher temperatures at which they operate increase the expansion and contraction in the boiler structure when it is cooled down or fired up. Faster servicing at the ash pits get the locomotives into the house carrying higher residual pressures and higher temperature. Excellent water treatment has made frequent washing of the boiler unnecessary and has reduced the amount of hot water available for the hot-water boiler washing plants.

Experience and tests have demonstrated the advantages of the cool-down system. It has been of great value in eliminating broken staybolts and boiler leaks. The boilers can be cleaned better because the sludge does not get a chance to bake on the boiler sheets. Pit work can be continued during the cooling down period. The work-

ing conditions for boiler men in the firebox is improved because the temperature is at a more comfortable level. These factors combined have made it possible to save as much as two hours in getting a locomotive back into service.

All these advantages make the cool-down system a worthwhile procedure to consider by all railroads operating modern steam locomotives.

Shall We Keep on Throwing It Away?

There are many indications that the railroads of the country are rapidly approaching a time when they are going to have to review their motive-power policies. These should be adjusted to bring the roads through the changing times of the next five or ten years with reasonable assurance that the total expense which they must pay for the "power to haul trains" will not be out of line for the then existing conditions.

The figures, for the past two years at least, lead inevitably to the conclusion that a realistic attitude toward the matter of facilities for the repair and servicing of steam locomotives should soon be taken or steam locomotive repair and servicing costs will increase disproportionately. In other words, if many railroads which have reduced their inventories of steam power because of the acquisition of Diesel-electrics are going to continue in service millions of dollars worth of obsolete shop and enginehouse facilities which they no longer have any use for there can hardly fail to be a substantial increase in the unit cost of servicing, maintaining and operating the declining inventory of steam locomotives. Furthermore where obsolete shop and engine-terminal facilities are used jointly by both steam and Diesel power the Diesel is, in many cases, bearing the burden of unjustified charges.

It stands to reason that under present conditions a basic consideration, when it appears no longer possible to control the cost of a man-hour of labor, is to control the use of man-hours. Obsolete facilities, which require a maximum of manual-labor hours as compared with mechanized-labor hours, are extravagant in the expenditure of man-hours and the expense accounts on many railroads are beginning to show it.

The responsibility for the wasting of millions of dollars out of the future revenues of the railroads because of this situation will not rest alone on the mechanical department, the operating department nor the engineering department. It will rest squarely on the shoulders of management—financial management as well as operating management. There are too many factors involved in this problem, which is as much an economic problem as it is an engineering problem, to be settled by any other method than a comprehensive study, initiated by top management, to find out what the facts are so that a policy consistent with conditions may be established and some practical plans adopted.

That there be no misunderstanding, may it be stated that this comment does *not* encompass any suggestion that the almost 1,100 large and small railroads of this continent can join in any "five-year plan" to solve the expense-control problem of servicing and maintaining motive power. Sixteen or more years of "master plans" have, if nothing else, proved the fallacy of that idea. This job is a job for the management of individual railroads —they will either succeed or go broke on the basis of individual efforts, and those efforts must include the willingness to profit by the economically sound ideas of other managements—both in the railroad and industrial fields.

Here are some facts. Approximately 84.6 per cent of the locomotive inventory is still made up of reciprocating steam units and of the remainder 13.5 per cent is Diesel-electric and 1.9 per cent is electric. A lot of people in the industry seem to be laboring under the impression that it is only a matter of a few years before there won't be any more steam power to be maintained. Some indication of the rapidity of replacement may be seen in the switching field where the process has been going on for 23 years. Today there are still 5,675 steam switchers as compared with 3,411 Diesel-electrics and, in freight yard-switching alone, for example, steam power still does 56 per cent of the work and the Diesels 34.8 per cent. Electric locomotives do most of the rest. Even on road passenger work steam power still hauls 61 per cent of the passenger train-miles as compared with 33 per cent for the Diesel-electric. It is only fair to say that most of the Diesel-electric units are performing these jobs in a manner that could not be equalled by existing steam units—and there is a real question as to whether the most modern steam power could equal Diesel performance on the "top cream" jobs.

So, in the fields of its greatest competition steam still does more than half of the work and we're going to have steam power for years to come. So what about facilities for its servicing and maintenance? Are the railroads going to ride through "with what they've got" in the matter of back shops and engine terminals or are they going to do something about getting rid of obsolete facilities in the form of buildings, shops and terminal tracks, boiler plants, shop machinery and equipment, coaling stations, water-service facilities and a hundred-and-one other man-hour-wasting pieces of property that are kept standing around where a laborer or a mechanic can make use of them to do a job in four or five hours that should be done in one hour?

A reason why these obsolete facilities remain as part of a railroad company's property is probably, in large part, because there hasn't been enough realism in the thinking of management to do a job of replacing old steam repair facilities with modern shops and shop equipment. The cost of steam-locomotive repairs, in 1947—527 million dollars, with 35,000 units to maintain—compares with 1929's cost of 409 million dollars, with 57,000 locomotives to maintain. True, the 1947 units made more mileage per unit, labor and material

costs have increased tremendously, the average age of the locomotives has increased, but the facilities for maintaining steam power have *not* been kept up to date.

Five hundred million dollars is a lot of money, even in these times, and a ten per cent reduction in steam-locomotive repair costs would pay the interest on a couple of billion dollars at today's money rates. Let anyone who thinks a ten per cent saving is fantastic ask any good shop engineer. His file of improvement projects "held in suspense" will provide the answer.

Where 10,000,000 Hp. Means 27,000,000 Kw.

The railroads of the United States start the year 1949 with ten million horsepower of Diesel-electric locomotives in their service.

Before trying to evaluate the significance of this figure, it should first be realized that 85 per cent of the locomotives, if not the horsepower, on Class I railroads are still steam. Locomotive maintenance is, therefore, still primarily one which concerns steam motive power. Whether the number of Diesels in service stops where it is, or goes on to include all motive power, is something for the poll takers to decide. A requirement of the moment is to measure the size and importance of the operating and maintenance requirements in each field.

The ten million horsepower is engine horsepower. To get this power to the rails requires at least an equal capacity of generators and an equal capacity of traction motors, or 20,000,000 hp. of motors and generators. Actually, it is more than this since these machines must transmit this power at low voltage and high current values and also at relatively high voltage and low current values. To meet this condition, these machines must have about 1.8 times the electrical capacity of electrical machines which operate at constant voltage. The capacity of these machines is, therefore, 20,000,000 hp. x 1.8= 36,000,000 hp.=27,000,000 kw. The magnitude of these figures becomes evident when it is pointed out that the total capacity of the central stations in the country is now about 55,000,000 kw.

The railroads, by and large, have acquired Diesel-electric locomotives at a much greater rate than they have developed facilities for their maintenance. Some of the locomotives are still so new that they have not developed any considerable maintenance costs, but most of them have been through a number of "cleanups" and are operating with rewound motors and generators. Still no excessive or prohibitive cost figures have developed. Electrical maintenance costs remain below the figures which were predicted, and it is only logical to assume that, as methods and materials are improved and mileage between cleanup periods is extended, these costs will be reduced. The amount of this reduction will have an important bearing on how much the number of Diesels will encroach on the remaining 85 per cent of the total.

NEW BOOKS

Drilling and Surfacing Practice. *Third Edition. By H. Colvin, editor emeritus, American Machinist, and Frank A. Stanley, formerly editor, Western Machinery and Steel World. Published by the McGraw-Hill Book Company, New York 18. 523 pages, 6 in. by 9 in., cloth bound. Price, $5.*

The third edition of Drilling and Surfacing Practice incorporated all major developments made in the art since 1936. Certain sections of the Wartime Data Supplement have been integrated in this text, thus including those techniques which have become standard postwar practice. Those improvements in carbide tools used on older machines are discussed in detail, as is also the trend toward the use of carbide bits held in milling cutter bodies by means mechanical, instead of brazed carbide tips. The increased speed in planing, resulting in the adoption of non-metallic bearing surfaces between bed and table to reduce heat developed by the all-metal contacts, has been considered, as well as its effect on accuracy.

Heating, Ventilating, Air Conditioning Guide. *Twenty-sixth Edition. Published by the American Society of Heating and Ventilating Engineers, New York. 1,280 pages, 6 in. by 9¼ in. Price, $7.50.*

The twenty-sixth edition of the Guide was brought up to date by the revision of over half of the 51 chapters. This publication is especially valuable to those in the mechanical department having the responsibility for designing and maintaining equipment for the heating and air conditioning of passenger cars, as well as shop buildings. The chapters on heating and transportation air conditioning have been given extensive revisions. Of interest at this time is the data on radiant heating which, while it does not apply specifically to railroad applications, is basic data on this important subject.

Turning And Boring Practice. *Third Edition. By Fred H. Colvin, editor Emeritus, American Machinist and Frank A. Stanley, formerly editor of Western Machinery and Steel World. Published by McGraw-Hill Book Company, New York. 514 pages, 6 in. by 9 in. Price, $5.*

The first edition of this book on machine tool practices in turning and boring work was published in 1935 and included the essential principles and major problems involved in the different operations on engine lathes, turret and semi-automatic lathes, automatic screw machines and boring machines. It also included a section on the cutting tools used on these machines for different materials. During the war years supplements to the first edition were brought out and now, in this third edition, these supplements have been revised and included in their proper place along with additional data on mandrel and taper work, precision boring for extreme accuracy, boring bars for special work and on carbide tools.

With the Car Foreman and Inspectors

Layout and Operation Of Light Repair Tracks*

By B. J. Huff†

The necessity for the prompt movement of all types of freight car equipment, both loaded and empty cars, in recent years to meet competition with other forms of transportation and to meet the demands of the service, and also to increase the availability of cars for service, has made it important that all cars be handled promptly on light repair tracks.

The rapid change in design of freight cars which has been made in the last 25 years from cars of all-wood construction, first to composite cars and later to cars of all-steel construction, has changed materially both the type of work to be performed on the light repair track and the facilities required for these repairs.

Since the modern freight car of all types has a much longer life between shopping dates for general repairs than the older cars, a greater portion of freight car repairs are made on light repair tracks. While these will vary greatly in size, layout and equipment requirements, there are certain fundamental requirements for all light repair tracks.

Location and Layout of Repair Tracks

The first step and certainly one of the most important in building a light repair track is its location. Too often the repair track is located on some tracks which are already available, or are made available with a minimum initial expense without consideration to availability or economy or efficiency of operation. The location should not be decided by the transportation or engineering departments alone, nor by the car department alone as a selection made by any one department would naturally be made for reasons favoring that department.

Light repair tracks should be so located in terminals that all light repair cars, both loaded and empty, can be repaired with a minimum of delay and back haul. They should be located adjacent to the classification yards and should be directly connected with switching leads to both ends of yards, regardless of switching practices. Repair tracks should be provided with one or more roadway entrances to permit operation of private automobiles, company-owned highway trucks, ambulances, fire department trucks and any other automotive equipment required. The roadway should permit access to repair tracks without crossing the tracks if possible. This arrangement provides much better fire protection, permits quick response to ambulance calls and eliminates crossing tracks being switched. It also facilitates the handling of road repair work promptly when a highway truck is used, and material is handled direct to the point required by the truck without loading and unloading from cars.

The design or layout of light repair tracks depends largely on the plan of operation used. At the present time most of our repair tracks are operated using the method of spotting bad order cars over the entire yard for repairs. Repairmen are moved with their tools to each car under repairs, and material is delivered to all parts of the yard as required.

A few railroads are using the spot system of light repairs where the cars are moved through certain spots where repairs are made. Some of these roads use the spot system of repairs for wheels and other truck repairs, including periodical repacking of journal boxes only, while some others work all cars possible using the spot system and set the other cars which cannot be repaired on various spots to some dead track for repairs. Cars which require wheels or other truck repairs are usually segregated and spotted on certain tracks and are moved to certain spots for the exchange of wheels, couplers, repacking of journal boxes, etc. These spots are equipped with permanent jacking pads, air jacks, jib cranes equipped with air or electric hoists for handling Bettendorf trucks for dismantling and assembling, and other special tools and equipment.

While there is objection by some to the spot system for light repairs, it does offer some inducements in its favor. In the first place, the size of the repair track can usually be reduced. The use of the special equipment mentioned above for handling repairs to trucks, along with material storage adjacent to these spots for wheels, has reduced the cost for this work as much as 50 to 60 per cent. Figures furnished by one railroad show that wheels are applied to Bettendorf type trucks in from 20 min. to 35 min., with an average time required of approximately 30 min. per car and approximately 2 man-hours per car. This is a considerable saving over the average time required when wheels are delivered to the car, which is usually approximately 4 man-hours per car, including all work.

The spot system of repairs permits the storage of material at points adjacent to the place where it is used, reduces the cost of handling material over the entire yard and eliminates time lost while waiting for material delivery. It also keeps the men employed in a much smaller area which reduces the time required to move from one job to another and the time required for handling tools and equipment over the entire repair track. Furthermore, the spot system will permit the assignment of more specialized gangs to various types of repairs such as truck work, couplers and draft rigging, riveting gang, wood work, etc.

While it will require from two to five minutes to move cars whenever a move is made with the spot system, it should reduce the lost time over the present method in many cases and give the men better direct supervision.

At points where a railroad desires to provide buildings for the protection of their employees from heat, cold or inclement weather, it is almost imperative that the spot system of repairs be used to conserve building space. Some railroads have provided protection from weather at the wheel spot only. An ideal spot system layout would have a repair yard consisting of four tracks, all of which should be connected with the switching lead at both ends of the yard. One track should be used for loading and unloading material and loading scrap. Two tracks should be equipped with the necessary permanent instal-

*Abstract of a paper presented at the November, 1948, meeting of the Chicago Car Foreman's Association.
†Assistant master car builder, C. & E. I.

lations previously mentioned, including a car mover for moving cars over repair spots. The fourth track would be on the opposite side for dead work. The length of these repair tracks would depend on the maximum light repair output required and the number of times these repair tracks were switched daily. The dead track is provided to take care of cars which cannot be repaired on the spot system and to employ men who cannot always be used continuously on the spot system. The latter track will take care of the objection of many that all light repair cars cannot be repaired using the spot system.

A daily output of 60 to 75 cars could be handled easily with a repair track as described above.

The spot system of light repairs can also be used on stub-end light repair tracks by locating the repair spots in the middle of the yard. With this arrangement, however, work would be delayed if the repair tracks were pulled and spotted during working hours unless additional cars were spotted on dead tracks.

Most railroads still feel that the former practice of spotting cars over the entire yard for repairs is the most practical and economical for their light repair track operation and this is no doubt true in many cases. It is important to have necessary automotive equipment, a well organized and efficient material supply system and sufficient supervision with this type of operation.

Repair tracks with track centers from 24 to 28 ft. apart provide ample space for roadways, material storage and movement of portable tools and equipment and automotive equipment. Track ballast should be of gravel, chats or stone and should be applied to a sufficient depth to make a good foundation for jacking cars and also to aid in surface and sub-surface drainage.

Roadways of concrete are most satisfactory. For some climates, roadways made from asphalt are satisfactory. Service tracks are used on some repair tracks, but roadways are preferable because they permit traffic to move in both directions at the same time without delays, permit the most efficient use of automotive equipment and facilitate the operation of all portable tools and equipment. Roadways which are constructed the full width of the spacing between tracks can be designed to take care of all surface drainage and equipped with sewer drainage openings. Numerous crossings should be provided to permit movement from one roadway to another.

Repair tracks should have water lines and hydrants for fire protection to buildings and cars. One track should be especially equipped for washing out cars. Air lines should be laid on top of the ground near the rail for easy accessibility for use and repairs. Air lines should have sufficient storage tanks to maintain proper pressure and also to eliminate as much moisture as possible. Electricity should be made available for lights and machinery required. A section of one repair track should be equipped with special lighting facilities, including stationary flood lights and plug-in sockets for portable flood lights, and extension cords for emergency work at night. Special sub-surface lines are especially desirable for connections for electric welders.

The size and layout of shop buildings depends, of course, upon the size of the repair track. If possible these buildings should be located on one side of the repair track as near the center of the track as possible and adjacent to the roadway entrance from the public highway. All buildings which require heat and hot water should be constructed in one unit to reduce the cost of construction, maintenance and operation. Buildings should be of fireproof construction and space should be provided for a blacksmith shop and mill room, airbrake room, tool room, wash and locker room and toilet facilities. Toilet facilities should be located on the first floor of building. The question of automatic heating should be considered. Some railroads are successfully using electrically heated vats with thermostatic controls for freight car packing.

The track on which the material is unloaded should be equipped with unloading platforms and material storage which should be as centrally located as possible. Material racks made from scrap steel material, such as scrap rail, channels or boiler tubes, make very satisfactory material racks for storing such material as brake beams, brake rods, spring plank and other similar material. A well laid out storage platform which is stenciled for storrage of various items encourages the orderly storage of all kinds of material.

A careful study should be made of the needs of each light repair track and every effort should be made to secure modern equipment. The most important and common types of equipment which can be used to advantage on light repair tracks are:

1—A jib or monorail crane equipped with air or electric hoist for loading and unloading mounted wheels, scrap and other heavy materials.

2—An automotive crane for handling wheels to and from storage in cars, picking up and loading scrap, placing heavy car parts on cars, unloading, loading material, etc.

3—Lift trucks for handling mounted wheels to and from storage, handling material and other similar heavy work.

4—Highway trucks of 1½-ton rated capacity or more, equipped with hydraulic drop-end gates for handling material, mounted wheels, emergency road repairs and small derailments where the steam derrick is not required.

5—Air-operated jacks for both loaded and empty cars, and special hand-operated jacks of various types such as coupler jacks, hydraulic journal jacks and floor jacks.

6—Portable steel end straighteners and load shifters.

7—An A-frame device for dismantling and assembling Bettendorf trucks.

8—Single-car testing outfits equipped with a reducing valve and strainers.

9—A combination wood-working saw.

10—Other miscellaneous tools such as draft gear and coupler lifts, special air or electric motors for raising and lowering auto loaders, oil-burning rivet heaters, hoists, portable acetylene cutting and welding outfits, portable electric welders, and air or electric motors for drilling and reaming holes in steel parts.

Operation of Repair Tracks

Since most light repair tracks do not have any special production system, the efficiency of their operation depends largely on the supervisory forces in charge. While it is important that prospective foremen have an intimate knowledge and previous experience in car work, it is perhaps of greater importance that they have good judgment, initiative, a sense of fairness for both the men and the company, the ability to organize the shop forces for the best production possible, and an ambition for leadership and achievement.

A careful inspection should be made of each car spotted on the repair track for repairs before the work is started. Foreman or inspectors responsible for this inspection should begin work in sufficient time ahead of workmen to take care of this work without delays.

An efficient organization is also necessary for the prompt delivery of the material required in order to avoid delays to the workmen. These men should work under the direct supervision of the light repair foreman. Sub-supply points should be established adjacent to repair tracks where small items of material can be secured directly by the workmen.

Special gangs should be assigned to various classes of

work such as truck and draft gear work, wood work, steel work, acetylene welding, air brake work, repacking journal boxes, etc.

When cars are shipped to the repair track for repairs of defects which do not require repairs or on which repairs could be postponed until after the cars move to destination or return home to owner, this should be brought to the attention of inspectors responsible in such a manner that it will develop good judgment of our inspection forces. Car inspectors and car repairers on our light repair tracks have an opportunity to get a type of experience which will prove invaluable to them if they take advantage of the opportunity.

Box Car Side Lifter

Hanging box car sides is simplified at the Illinois Central, Centralia, Ill., shops by using a side lifter that is suspended from the main shop traveling crane. The lifter has two suitably shaped members, one mounted on either end of the main horizontal member, which engage the underneath side of the top member of the door frame. After the lifter has been lowered into the approximate position for engaging the door frame top, a latch mounted on the center of the horizontal member is tripped to lock the lifter in place by a man using a 10-ft. pole. After the car side is secured in place on the car by drifts and fitting-up bolts the lifter is released by tripping the center latch with the 10-ft. pole.

The lifter is suspended from the hook of the crane by a steel ring 1-1/2 in. by 10 in. This ring carries the engaging portion of the lifter on two chains, the bottom ends of which are fastened to the lifting members on opposite sides of the horizontal main member.

The horizontal supporting member of the engaging portion is 3/4 in. by 3 in. by 5 ft. To either end of this member is welded a piece of steel plate which has a cross section 6 in. by 1 in. and is bent to the general shape of a question mark with an overall height of approximately 15 in. and a width of 4-1/2 in. Two small blocks of steel approximately square in cross section and a little over 1 in. on a side are fastened to the question-mark-shaped end pieces to prevent excessive clearance around the door frame top during the engagement of the lifter with the sides.

To the center of the horizontal member is welded a piece of plate steel formed to a channel shape with the open end facing the side of the horizontal member. The opening formed between this channel and the horizontal member carries the lock by which the lifter is secured to the car side. This lock consists of a piece of 5/8 in. plate bent to an angle shape with one 4 in. leg and one 7 in. leg. The latter is in the vertical position and has a 1/2 in. bolt welded to the bottom to prevent the angle from falling out of the guide during handling.

Lifting device for hanging box car sides—The two end members are shaped like a question mark for engaging the bottom of the top door frame—The L-shaped center member locks the lifter in place to the car side for hanging operation

The Cost of Using Jacks

By F. H. Schwerin*

There is a wide variance in the cost of jacking loads, depending entirely on the kind of jacks used, rack jacks, screw jacks, or air-operated power jacks.

In the present period of high wage rates, the operation of jacking can be quite costly. In jacking loads on which normally 20-ton jacks are required, if two rack jacks are used near their capacity, two men operating each jack at four strokes per minute, the load will be raised 1-¼ in. Then, to raise the load 8 in. would require 8÷1.25=6.4 minutes, and with two men per jack, we have 4 times 6.4=25.6 man-minutes to raise the load, and the same for lowering, or a total of 51.2 man-minutes. This, at a wage rate of $1.20 per hour equals 2 cents per minute resulting in a cost of 51.2 times 2 cents=$1.024 the cost of the jacking operation.

Using two screw jacks of the self-lowering type on this load, one man per jack at six strokes per minute will raise the load .702 in., and the 8-in. raise will then be made in 8÷.702=11.4 minutes. For two men this equals 2 times 11.4=22.8 man-minutes for raising the load 8 in., plus two man-minutes for lowering, or a total time for jacking of 24.8 man-minutes, costing 2 cents times 24.8=$0.496 for the jacking operation with this type of jack, indicating over 100 per cent saving over the rack type of jack.

If we now consider this load being raised with two air power jacks, and both jacks connected with the hose and Y-valve assembly, one man can operate both the jacks, resulting in the following jacking costs:

Air-operated power jacks will raise this load at a rate of 6.2 in. per minute or 8÷6.2=1.29 minutes for 8 in., and 1.29 minutes to lower or a total of 2.58 man-minutes, this time will cost 2.58 times 2 cents=$0.0516. These jacks each use approximately 90 cu. ft. of air per minute at a cost of 5 cents per thousand cu. ft. equals 2 times 2.58 times 90 times .05÷1,000=$0.023 the cost of the air used, this added to jacking cost equals $0.0516 plus $0.023=$0.0746, the cost of the total operation. This is a saving over either of the former two methods and is without operator fatigue resulting from hand operation such as with rack jacks. Therefore, additional savings result by use of air power jacks in that the operator can proceed at once with the repair work, no rest period being required. Therefore, by the use of air power jacks, the overall savings in labor cost would in a short time pay for the price of air power jacks.

*Chief engineer, Duff-Norton Manufacturing Company.

TOTAL COST OF JACKING ONLY, 20-TON JACKS

Total cost of jacking 8 in. with rack jacks	$1.02
Total cost of jacking 8 in. with self-lowering screw jacks	0.50
Total cost of jacking 8 in. with air power jacks	0.07

On heavy loads, where 50-ton jacks are usually used, and considering the self-lowering screw jacks, under near capacity loads, the cost of jacking will be approximately as follows:

Making sixty-degree strokes at six strokes per minute will result in ½ in. raise with these jacks. Therefore, to raise 8 in. requires 16 minutes, and with two jacks under a load, one operator at each jack, 32 man-minutes are required for raising the load. If we then allow one minute for each jack to lower, we have a total of 34 man-minutes. At the rate of 2 cents per minute, our total cost for the jacking operation then equals 64 cents with these jacks.

Using air-operated power jacks for this work, the load will be raised in two minutes with one operator. (If a hose Y-valve is used, we have a total of two man-minutes to raise the load.) If we assume the same time for lowering the load, we obtain a total of four man-minutes at a cost of 4 by 2 cents=8 cents. The air cost will be 110 cu. ft. per min. times 2 minutes times 2 jacks equals 440 cu. ft. total, and at 5 cents per 1,000 cu. ft. will cost 440 times .05÷1,000=2.2 cents for the air used.

The labor cost of .08 plus the air cost of .022=10.2 cents, the total cost of the jacking operations with 50-ton air power jacks.

Here again a saving of labor is indicated by the use of air power jacks.

TOTAL COST OF JACKING ONLY, 50-TON JACKS

Total cost of jacking 8 in. with self-lowering screw jacks	0.64
Total cost of jacking 8 in. with air power jacks	0.10

For loads requiring 100-ton jacks, the best hand-operated jacks available are the self-lowering screw jacks, and the air power jacks.

Using two screw jacks under the load, if the load is to be raised 7½ in. each 60-deg. stroke will raise the load .054 in. and at the rate of six strokes per minute, the load will be raised .323 in. per minute. Therefore, to raise 7½ in. will require 7.5÷.323=23.8 minutes for two jacks, and two men operating each jack, we have a total of 23.8 times 4=95.2 man-minutes to raise the load and four man-minutes to lower (one minute for each jack) the load or a total 99.2 man-minutes, which at 2 cents per minute makes the cost of the total jacking operation $1.98.

If this jacking is done with a pair of air power jacks with Y-valve assembly and one operator the load is lifted in three man-minutes for raising plus three man-minutes for lowering, or a total of six man-minutes.. This cost (at 2 cents) equals 6 times 2 cents=12 cents jacking cost. The air used for this complete operation will cost, using 115 cu. ft. of air per min. at 5 cents per 1,000 cu. ft. 115 times .6 times .05÷1,000=3.4 cents. The labor cost of 12 cents plus the air cost of 3.4 cents totals 15.4 cents, the total cost of this jacking operation with air power jacks.

TOTAL COST OF JACKING ONLY, 100-TON JACKS

Total cost of jacking 7½ in. with self-lowering screw jacks	$1.98
Total cost of jacking 7½ in. with air power jacks	0.15

On heavy repairs, two men may be required so that the man-minutes may be doubled. In the study of the 100-ton air-operated power jacks showing a total cost of 27 cents, the savings effected by the use of the air jacks indicate over 600 per cent even though a man is stationed at each jack.

In all of these studies, the time used for hand operated jacks was considered as the best that could be obtained by continuous operation of the jacks with no rest periods so that the actual total time of jacking may easily be doubled and consequently the cost of jacking with hand-operated jacks would be over the figures used in these comparisons.

A.W.S. Forum On Welding Practices

An open meeting on welding was sponsored by the Railroad Welding Committee of the American Welding Society on October 26, 1948 during the annual meeting of the society at Philadelphia. The open meeting was scheduled for the purpose of giving railroad men an opportunity to present any question on any phase of railroad welding. The program was divided into the following topics: Passenger-Car Welding, Freight-Car Welding, Locomotive Welding. To start the discussion of each topic a short introductory talk was made by on outstanding welding authority in the field for each subject. Abstracts of the discussions will be included in this and following issues. The names of the speakers will be omitted from the abstracts published in the *Railway Mechanical Engineer*.

The chairman of the meeting was L. E. Grant, Engineer of Tests, Chicago, Milwaukee, St. Paul & Pacific. Mr. Grant is also chairman of the Railroad Welding Committee, American Welding Society.

Passenger-Car Welding

Q.—The introductory talk mentioned roller seam welding in the construction of passenger cars. I would like to know how successful it has been and what are the gauges that have been welded successfully, and at what speeds.

A.—Our roof corrugation, which is .020-in. metal, is welded at about 65 to 70 inches per minute. You can get a little higher than that, though we normally do not. We do some comparatively heavy welding, as far as seam welding is concerned, using .075-in. metal for our water tanks. We do that welding at about 50 to 55 inches per minute. We have never been successful in using some of the advertised speeds of seam welding. We hear of 400 inches a minute but I have never seen a good seam weld made at that speed.

Q.—Will someone comment on stud welding?

A.—I can't see any good reason why a stud welder can't be used in the car building industry as well as in the shipbuilding industry. There they use it to fasten clips for conduit, plumbing, piping, wash room fixtures, and so on. Of course, I can see that on the lightweight stainless structures it might tear out if you put it right on the sheet, but I think it could be used where the sheet comes in contact with the structural member. You would have sufficient support there. If it's good in the shipbuilding industry I think it ought to be good in the car building industry.

Q.—With lightweight construction, how thin can you go? In other words, how thin can you weld to before you start running into difficulties?

A.—I believe one of the troubles with the application of stud welding in the car building industry is the fact that too heavy a stud is used on light gauge materials. I believe it is purely a question of design. I know in some cases, three-eighths and half-inch studs are put on 1/8-in. and 3/16-in. materials—for what purpose I don't know. But if you would get the stud size down somewhere to the point where you could get a sound welding material, I don't think you would have any trouble.

Q.—Our problem has been on repairing the side sheets

in the case of sideswipe or a dent. We have to cut sections out and weld another section in. We have been testing the inert arc process but we don't always get the best results. Has anyone else had the same experience?

A.—The main trouble is the last weld made. It doesn't always hold. There is no way to overcome the contraction.

Q.—Do you patch?

A.—Occasionally we do it, but then it is fluted.

Q.—That's right. You can't do much dishing in that. Have you tried the ordinary metallic arc type?

A.—Yes, we have. Every time a new type of welding comes out, everybody seems to think it is the cure-all for all these troubles that they have had with the process they have been using. That isn't always the answer. Sometimes the older process is better than the new one for a particular application. That is why I raised the question: have you done any of this welding with the ordinary metallic arc? It has come to my attention lately any number of times that people have tried to do something with inert welding on stainless steel particularly, and they would be better off if they would leave it alone and stick to the old metallic arc. As far as stainless steel goes, really the only application for inert gas shielded arc welding is on the light gauges. When you get stainless steel of any weight at all, and you've got to put it together, say a sixteenth up, you're better off to use the straight metallic arc and forget the inert arc.

I think the thickness of this material is something like .028, which is very light.

It seems to me that in the repair of passenger cars and other cars, we try sometimes to make a local repair when the material is relatively cheap to labor, and if the complete area up to the main supporting members was removed and replaced we could save money, rather than attempting to repair locally. When you think of your labor and your overhead costs, the cheapest thing is to cut the defective part out and put a whole new panel in.

I believe some of these damaged sections are only two or three square feet in area, and some of these cars are 72 or 78 feet long. If you could just take that section and put a piece down from there to either end of the car—it usually occurs near one end of the car—and make one horizontal weld, you will be able to make a better appearance.

Effect of Air And Moisture on Freon

By E. E. Murphy*

The elimination of the deteriorating effect of chemical reaction of moisture, air and freon is a serious major problem in successful operation of railroad air-conditioning equipment.

The deteriorating effect of air and moisture in railroad air-conditioning equipment cannot be overemphasized. Studies of failure, interruption in service, and abnormal maintenance costs bring this to light. Air and moisture react upon Freon (F-12) refrigerant to form hydrochloric acid (also known as muriatic acid) and results in "copper plating" of the compressor bearings, etching or corroding of expansion valves and other steel parts of the system. Another result is the gradual rusting of the interior of the compressor body. These reactions are observed on railroad equipment more so than in other applications due to more frequent replacement of component parts of the system from various causes.

One of the first indications of moisture in the Freon system is the coating over of the receiver sight glasses with a brownish rust film and the clogging of the liquid line and expansion valve strainers with a heavy deposit of fine rust particles. Many replacements of expansion valves for failure to regulate the flow of refrigerant are due to etching of the needle valve because of hydrochloric acid in the system.

The conclusion from these observations is that railroad installation and maintenance forces generally are not taking sufficient precautions in the installation and maintenance of equipment to alleviate troubles due to these destructive agents.

The equipment manufacturer takes care to see that the equipment is processed and delivered to the user free of moisture only to have his efforts in this connection nullified in the installation and maintenance. Early precautions should be taken to prevent moisture and air breathing into the systems.

Connection seals on units, such as condensers, evaporators and compressors, should not be removed prematurely and allowed to remain open to the atmosphere any longer than absolutely necessary. The system should be thoroughly evacuated preliminary to charging it with Freon and operated for several hours with a good dehydrator in the circuit before being released for initial service.

Maintenance forces should be provided with properly processed condensers, compressors, evaporators, etc. Processing of these units should be done by baking and the use of a good vacuum pump to remove all traces of air and moisture and then sealed.

The handling of the compressor refrigerant oils to prevent absorption of moisture and oxidation is another precaution that should be rigidly observed. Reaction of Freon 12 and moisture will cause a breakdown of refrigerant oil, indicated by the blackish, brown color of the oil.

The problem is now resolved as to what means can be taken in a practical and economic way to prevent this deterioration of equipment. The application of quick-disconnect self-sealing couplings to condenser, compressor and evaporator units is a practical means to this end.

These couplings can be installed to replace stop valves or compressor units. Thus, in addition to utilizing them as stop valves, they serve as a quick disconnecting means and, when disconnected, seal the equipment and Freon system from the atmosphere, excluding moisture and air. The processing of air-conditioning units after having been open to the atmosphere is an expensive and time consuming operation which can be reasonably eliminated through the use of these couplings for this purpose.

Excessive liquid or condenser pressure should be eliminated. Operating temperatures of over 150 deg. cause rapid chemical reactions. At 250 deg. this reaction is 85 per cent faster than at 150 deg. and results in chemical breakdown of oil and Freon when contaminated with moisture.

The use of quick disconnect self-sealing couplings eliminates the "opening up" of systems to the atmosphere, also the necessity of unsoldering and resoldering connections when replacing equipment, reducing the labor costs in this operation and failure due to improper soldering of connections. In interchange service an important time and labor-saving can be achieved if the interested railroads adopt a particular type of quick-disconnect self-sealing coupling and installation as "standard". This is extremely important today in view of the necessity of reducing the amount of train equipment investment by elimination of extremely long layover servicing time, thus keeping costly equipment in revenue service to earn return on investment.

*Engineer Diesel and electric locomotive design, Union Pacific, Omaha, Neb.

Monorail Hoist For Cleaning Tanks

*By W. E. Abbott**

Part of the equipment for maintaining Diesel-electric locomotives at the New York Central, North Bergen, N. J., enginehouse consists of a series of three tanks and drain board. These tanks and drain board are used mainly for cleaning air-intake filters, and other parts, of Alco-GE, Diesel-electric 660-hp. switchers. The first tank holds a strong, hot cleaning solution, the second tank holds hot water, and the third tank hot oil.

The filter to be cleaned is first lowered into the cleaning solution, after which it is raised above the tank for draining. After draining, it is put in the hot water tank, and again raised for draining. It is next put in the hot oil tank, and then placed on the drain board where excess oil drains back into the hot oil tank.

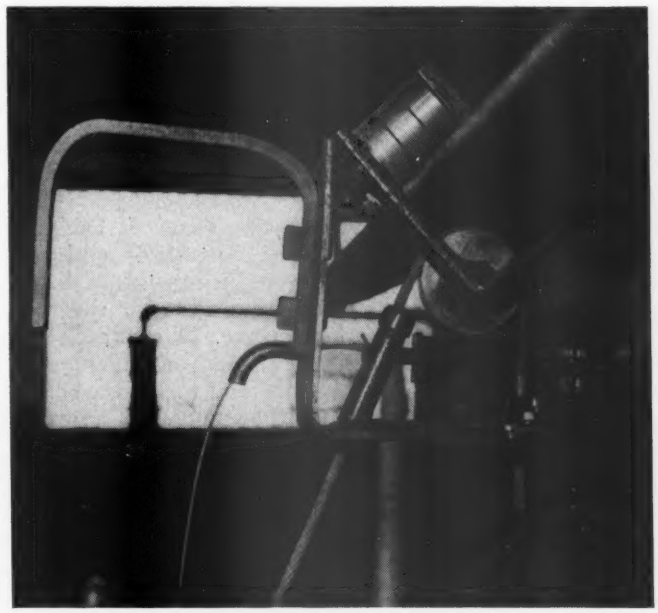
To prevent operators burning their hands, the mechanical handling device shown in the illustration was designed and built by shop forces. All of the material was available except the pulley, which was turned out on a lathe.

The rail is an inverted angle iron supported at three points by vertical and horizontal sections of pipe electrically welded to the angle. The carriage and hoist are combined into one unit. The carriage consists of four sets of rollers, two sets on each side, which are mounted as shown.

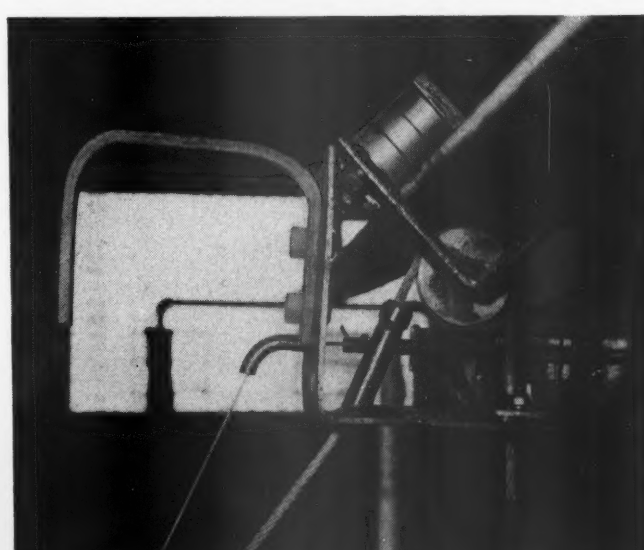
The pulley for the hoist is mounted in a slot cut into the angle iron to which the rollers are attached. The slot is cut for entrance of the pulley from the bottom, and clearance for the cable. The pulley turns on a pin which rests at the bottom of the angle iron.

*New York Central, North Bergen, N. J.

The hoist as used for oil filters



The carriage with the cable sleeve resting on the lock



Tension on the small cable opens the lock as shown

A U-shaped iron made from ¼-in. flat iron is attached to the angle iron at the two ends. This U-shaped portion has a handle bolted to it, as well as the locking arrangement necessary to hold the load in a raised position for draining, or moving to the next position.

The 5/16-in. hoist cable has a handle attached at one end, and a hook at the other end. At a suitable distance from the hook, a sleeve with the top tapered, is attached to the cable by solder.

The cable runs up through a pipe nipple guide, over the pulley, down through the locking device, and to the hook end. The locking device closes by spring pressure and is unlocked by pulling on a small wire cable, running through a bent pipe nipple guide.

In operation, the hook is attached to the load, the han-

dle on the cable is pulled down, and as the load rises, the sleeve passes up through the locking device. The lock closes in under the sleeve. Tension can then be released from the cable, and the load will be carried in a raised position by the carriage.

When the load is to be lowered, strain is placed on the hoist cable, and the small cable to the locking device is pulled, releasing the lock, so that the load can be lowered.

Brake Shoe Application Jig

A brake-shoe holding device at the Texas & Pacific's Marshall, Tex., enginehouse eases the task of applying locomotive brake shoes while reducing the risk of pinched fingers and eliminating the need for the mechanic to crawl under the locomotive. The brake-shoe applier consists of a three-legged stand on which rests a lever shaped and formed on one end to hold a brake shoe. The lever is supported on the stand at its approximate center; depressing one end raises the brake-shoe into position. When the shoe is raised so that the key-hole slot is adjacent to the recess in the brake head, the lever slips out from under the shoe, leaving the brake-shoe part way in place. It is pried over with the lever to align the openings for the brake-shoe key and locked in position with the key.

One leg of the three-legged stand is made from a 24-in. length of strap iron 3/8 in. by 2½ in. The leg is straight for the first 16 in., and the last 8 in. is bent 30 deg. from a straight line. Two bars ½ in. by 1 in. are welded to each other and to the bent leg just above the bend to form the remaining two legs of the stand. The bent portion of the one leg, which is vertical on the finished stand, has a slot ¾ in. by 2 in. Into this slot fits the brake-shoe lifting lever which is about 4½ ft. long and made from bar stock ½ in. by 1 in. The end of the lever that engages the brake-shoe is formed to a hook. On the other end a handle 1 ft. long is welded perpendicular to the lever for applying the force which raises the brake-shoe into place.

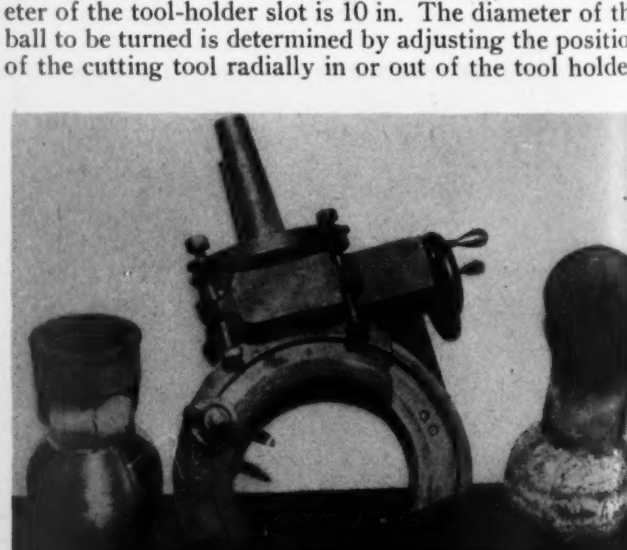
Lifting a brake shoe into place with the application jig—When the shoe is partially in position resting on the brake head, the lever is withdrawn and used to align the key holes for application of the key

Jig for Generating Spherical Surface

The spherical surface of booster balls is automatically generated at the Springfield, Mo., shops of the St. Louis-San Francisco by a jig which is set up by simply inserting it in the tail stock of a lathe. The worn ball, which has been built up by bronze gas welding, is held in the lathe chuck. The tool post fits in a circular slot in the jig and has its own separate feed. This moves the tool around the turning ball and generates a sphere.

The jig consists of a tool-post-holding section and Morse taper end which fits in the dead center hole in the tail stock. The taper shank is attached directly to one corner of a block 3 in. thick by 10¾ in. long by 8 3/8 in. high, from which a notch 3 1/8 in. by 5¾ in. adjacent to the cone area has been removed. The bottom of the block is forged down to a thickness of 1½ in.; the plane plate formed by the forging operation is parallel to the axis of the arbor and extends out from the block on the side opposite to the arbor. To this 1½-in. plate is bolted a 135-deg. segment of a circle 3 in. wide and 2 1/8 in. deep. It has a T-slot with a maximum depth of 1 in. and a maximum width of 2 3/8 in.

A second segment, in which is held the cutting-tool post and which is equal in all dimensions to the first, fits into the T-slot of the first segment. On the bottom of this segment is a circular key with an inverted tee cross section which slides in the slot of the first segment. Here teeth are cut along the outside circumference of the movable segment. It is rotated in the stationary segment by a worm gear which engages the teeth and which is turned by a wheel crank. The diameter of the tool-holder slot is 10 in. The diameter of the ball to be turned is determined by adjusting the position of the cutting tool radially in or out of the tool holder.



Jig for generating spherical surfaces on booster balls—The tool-post segment is turned in the bottom segment by the worm gear connected to the wheel crank at the upper right—On the right is a built-up booster ball before turning and on the left is a finished booster ball

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

Release and Charging

751—*Q.—What is the purpose of seal* 87 *and choke* 83? A. To limit the rate of charging chamber *C* during initial charging of the brake system and during the time the brake is being released, to aid in preventing overcharging of chamber *C* and the auxiliary reservoir.

752—*Q.—How does the service piston head function in this position?* A.—In retarded recharge position the piston head uncovers charging choke *83* and charging port *X*.

753—*Q.—Describe the flow of air through charging port* X. A.—Brake pipe air from chamber *A* charges through: Charging port *X*, passages *5b* and *5c*, check valve *89a* to slide valve chamber *C* and passage *5* to the auxiliary reservoir when cock *157* is open.

754—*Q.—What is the purpose of check valve* 89a? A.—This check valve permits air from the brake pipe to the auxiliary reservoir, but is held seated by a spring to prevent back flow when the brake pipe pressure is lower than that in passage *5*.

755—*Q.—Describe the flow of air through choke* 83. A.—Brake pipe air in chamber *A* charges through charging choke *83* to service slide valve chamber *C*, thence through passage *5* to the release slide valve chamber *D* and the auxiliary reservoir.

756—*Q.—When is charging change-over cock* 157 *open?* A.—In passenger service or short trains.

757—*Q.—What difference does open position of this cock make?* A—With cock *157* open, brake pipe air from chamber *A* charges chamber *C* and the auxiliary reservoir through passage *5b*, cock *157*, passage *5c*, choke *81*, and past check valve *89a*, in addition to flow through choke *83*, thus a faster rate of recharge of chamber *C* is provided on such trains in retarded recharge position.

758—*Q.—What other communications are open from the auxiliary reservoir in chamber* C? A.—The service slide valve chamber *C* and the release slide valve chamber *D* are at all times connected by passage *5*. Auxiliary reservoir in chamber *C* is also connected through ports *E* and *13* to chamber *K* on the spring side of piston *110*.

759—*Q.—With air pressure on the release piston* 110 *balanced, what happens?* A.—Spring *120* moves the release piston and attached slide valve to release position.

760—*Q.—What connections are made with the release slide valve in this position?* A.—Slide valve cavity connects displacement reservoir and relay valve passage *3a* to exhaust passage *10*.

761—*Q.—How does this connection affect the position of the relay valve?* A.—Passage *16*, leading to the relay valve, is connected through passage *36* to passages *3* and *3a* and the displacement reservoir. As the latter is open to the release slide valve exhaust passage *10*, the relay valve is in release position, connecting brake cylinders to the atmosphere.

762—*Q.—What other volume is charged simultaneously with the auxiliary reservoir?* A.—Emergency reservoir, from release slide valve chamber *D*, through passage *22*, past ball check *88* and flat check valve *89* and passage *2*.

763—*Q.—How do the check valves* 88 *and* 89 *function?* A.—They permit the charging flow as long as auxiliary reservoir pressure is higher than emergency reservoir pressure, but when the emergency reservoir pressure is higher than that in the auxiliary reservoir, the check valves are seated with the aid of spring *90*.

Locomotive Boiler Questions and Answers

By George M. Davies

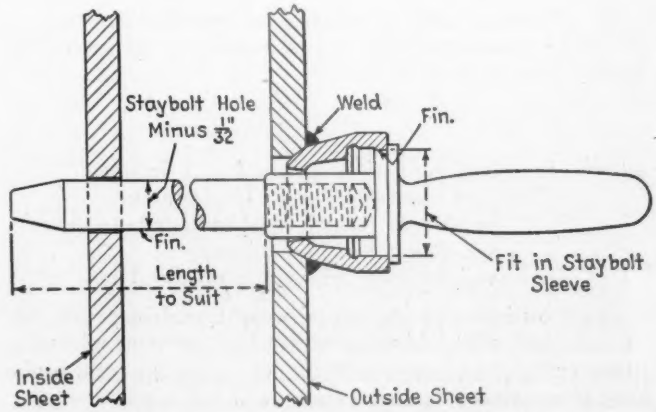
(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Aligning Staybolt Sleeves

Q.—When applying welded-type flexible staybolt sleeves to the wrapper sheet of a locomotive, are the sleeves applied to the wrapper sheet before the staybolts are applied? If so, how are the sleeves positioned so that they will be in alignment with the bolts?—D.F.M.

A.—Welded flexible staybolt sleeves can be applied at the same time the staybolt is screwed in, or the sleeve can be welded to the wrapper sheet before the bolt is applied. Both methods are used.

When applying the welded type sleeve with the staybolt, the sleeves are set in the prepared holes in the wrapper sheet, the bolts are then screwed in, the bolts positioning the sleeves in the wrapper sheet. The sleeves are then welded. When welding, the threaded part of the sleeve should be covered to protect the threads from metallic sparks from the electrode. With this procedure



Applicator for positioning staybolt sleeve

all the bolts can be appiied and the sleeves positioned, permitting welding of the sleeves as a continuous operation.

When applying the sleeves to the wrapper sheet before the staybolts are applied, a sleeve applicator, as illustrated, is used. The applicator positions the staybolt sleeve with respect to the staybolt hole on the inside sheet. The sleeve is then welded to the wrapper sheet.

Discussion of Boiler and Arch Tubes

Q.—The locomotive boiler in question uses 3⅛-in. O.D. No. 11 B.W.G. boiler tubes. Would it be satisfactory to use one of these tubes for replacing an arch tube in the same boiler? R.B.M.

A.—It would not be satisfactory to use one of the regular boiler tubes to replace an arch tube in the same boiler because the boiler tubes in the shell are subjected to external pressure and the arch tubes to internal pressure.

The thickness of the boiler tubes is determined from the following formula:

$$t = \frac{PD}{15{,}500} + (.065)$$

where
t = thickness of tube wall, in.
P = maximum allowable working pressure, lb. per sq. in.
D = outside diameter of tube, in.

Assuming the locomotive to have a working pressure of 225 pounds, substituting we have:

$$t = \frac{222 \text{ x } 3.5}{15{,}500} + .065$$

$$t = .0506 + .065$$

t = .1156 inch = thickness of tube wall or No. 11 B.W.G. as stated in the question.

The thickness of arch tubes required for the same boiler is determined from the following formula:

$$t = \frac{PD}{16{,}000} + \tfrac{1}{8} \text{ in.}$$

substituting we have:

$$t = \frac{225 \text{ x } 3.5}{16{,}000} + .125$$

$$t = .0492 + .125$$

t = .1742 in. = thickness of tube wall or No. 7 B.W.G.

Thus, a boiler having No. 11 B.W.G. boiler tubes would require No. 7 B.W.G. arch tubes for the same working pressure.

Questions and Answers on Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Bushing Pressures

Q.—What pressures should be used when applying piston-valve and cylinder bushings to locomotive cylinders?—V.E.D.

A.—For cast iron cylinders use 1 to 1½ tons pressure per inch of diameter for piston-valve and cylinder bushings. For cast steel cylinders use 1½ to 2½ tons pressure per inch of diameter for cylinder bushings and 1½ to 2 tons pressure per inch of diameter for piston-valve bushings.

Braking Ratios

Q.—How is the braking ratio of a locomotive determined? What are the braking ratios used in steam locomotives?—P.E.D.

A.—Nominal braking ratio is the hypothetical ratio of the brake shoe pressure to the weight borne by the braked wheels. The formula is:

$$R = \frac{P}{W}$$

where R = braking ratio expressed as a decimal
P = total theoretical brake shoe pressure in pounds (which may be distributed over any number of brake shoes)
W = weight upon braked wheels in pounds

If a locomotive having a total weight on drivers 201,500 lb. is braked with a braking ratio of 60 per cent when the brake cylinder pressure is 50 lb. per sq. in. the total brake shoe pressure is assumed to be:

$$201{,}500 \times 0.60 = 120{,}900 \text{ lb.}$$

If this weight is carried on three pair of drivers, or six wheels, each one of which is retarded by one brake shoe, the brake shoe pressure will be nominally 20,150 lb. per brake shoe as long as the brake cylinder pressure is maintained at 50 lb. per sq. in.

Braking percentages in general use are as follows:

		Braking Power, Per Cent	
Kind	Brake Schedule	Passenger	Freight Switching & Mallet
Driver	No. 6ET	60	50
Engine truck & trailer	D (used with 6ET)	45	45
Tender	No. 6ET	80	70

Articulated Locomotives

Q.—Are all four-cylinder steam locomotives articulated?—R.M.J.

A.—An articulated locomotive has two sets of frames or engine beds, which are connected by a hinge or joint. The driving wheels are divided into two groups and the wheels of each group are rotated by a separate pair of cylinders. In this way a large number of driving wheels can be used, while the rigid wheelbase is that of one group of driving wheels only, and the locomotive can therefore traverse curves without difficulty. Articulated locomotives are usually built with either three or four pairs of driving wheels in each group, and also with front and rear trucks which may have either two, or four wheels per truck.

There are in service a number of four-cylinder locomotives which are not articulated in that they have rigid frames, with two groups of driving wheels and all four cylinders working in single expansion. In some cases both pairs of cylinders are placed ahead of their respective groups of wheels, while in others the cylinders of the rear group are placed behind the driving wheels. The first arrangement involves a long driving wheelbase, the needed flexibility being obtained by us-

ing lateral motion devices on one or more pairs of drivers. With the second arrangement, the driving wheelbase is no longer than that of a locomotive having all wheels coupled in one group, but it involves the equivalent of backward running for the rear cylinders. All locomotives of this general design have one-piece beds with frames, cylinders and various other attachments cast integral.

Sand Pipe Capacity

Q.—What is the recommended size of sand pipes and the rate of sand delivery for locomotives?—I.M.R.

A.—The A.A.R. Manual recommends the following: Sand pipes are to be 1-in. extra heavy when applied at each wheel or 1¼-in. extra heavy if not applied to each wheel; the rate of sand delivery per sand pipe, one pound per minute on locomotives having the sand pipe applied at each wheel with a maximum of 3¼ lb. per minute on locomotives where sand pipes are not applied at each wheel; on drivers equipped with laterial motion device, or lateral cushioning device, sand pipes should be provided with a flexible arrangement so that the sand pipes can follow the driver when taking curve.

Safe Rail Loads

Q.—What load can be carried on the driving wheels of a locomotive operating on 90-lb. rail?—F.E.K.

A.—The weight per wheel which can be safely carried for each pound weight of rail per yard is approximately as follows:—Light rails (60 lb. and less per yard)—250 lb.; medium weight rails (60-90 lb. per yard)—300 lb., and heavy rails (90 lb. and over per yard)—350 lb. Without considering the counter-balancing of the driving wheels rails weighing 90 lb. per yard can safely carry $90 \times 350 = 31{,}500$ lb., or 63,000 lb. on each pair of driving wheels.

Diesel Locomotive Questions and Answers

By J. R. Benedict

Q.—How does high water temperature affect the oil?

A.—High water temperature will cause the oil to become thin. The oil is cooled in the oil-cooler radiator by engine water coming from the water radiators. The oil temperature should be from 15 to 35 deg. above the water temperature during normal operation. Any higher oil temperature may be caused by a clogged oil cooler, stuck oil-cooler by-pass valve or a dirty water-cooling system.

Q.—What is normal oil pressure and when is the engine unsafe to run due to low pressure?

A.—Main bearing oil pressure when normal (engine water temperature at 165 deg.) should be 30 to 50 lb. in the 16-cylinder engine at full throttle and 25 to 50 lb. in the 12-cylinder engine. At idling the pressure should not be below eight pounds. The engine will be unsafe to run if the main bearing pressure (engine water temperature at 165 deg.) drops below 20 lb. in the 16-cylinder engine and below 18 lb. in the 12-cylinder engine.

Q.—How about the cracked piston-cooling manifold and cracked "P" pipes?

A.—A cracked piston-cooling manifold must be located by an examination of the entire manifold, taking especial notice of gaskets and connections of "P" pipes. Cracked "P" pipes may be checked by filling the "P" pipes with oil from an external pump or by barring the engine over several times, and holding a rag above the "P" pipe to prevent oil dripping from the crankcase while wiping the "P" pipe dry with another rag. Observe "P" pipe carefully for cracks at curved sections and at pipe lip.

Q.—What is the normal piston-cooling oil pressure and at what point does low pressure make operation unsafe?

A.—The piston-cooling oil pressure when normal (engine water temperature at 165 deg.) should be 20 to 30 lb. on all types of engines. at full throttle and 2 lb. or over when idling. The engine will be unsafe to run if the piston-cooling pressure (engine water temperature at 165 deg.) drops below 15 lb. on any type of engine.

Q.—How do the electric switches connected to the oil system function?

A.—There are two electric switches connected to the lubricating oil system. One is the low-oil pressure switch, the other is the high-suction switch. On engines not equipped with an electro-hydraulic governor a low-oil alarm will be given by the low-oil pressure switch any time the main-bearing pressure drops to approximately 9-15 lb. or 18 in. vacuum is established on the oil high-suction switch. If dirty pressure-pump suction screens cause the high suction switch to operate, it can be determined by opening the throttle to the eighth notch. When the engine speed rises to a maximum the high suction switch will reduce this speed to idle. The engine speed reduction will reduce the vacuum on the switch and the switch will close, returning the engine speed to maximum. This intermittent oil alarm and engine-speed fluctuations are positive indication of high-suction switch operation.

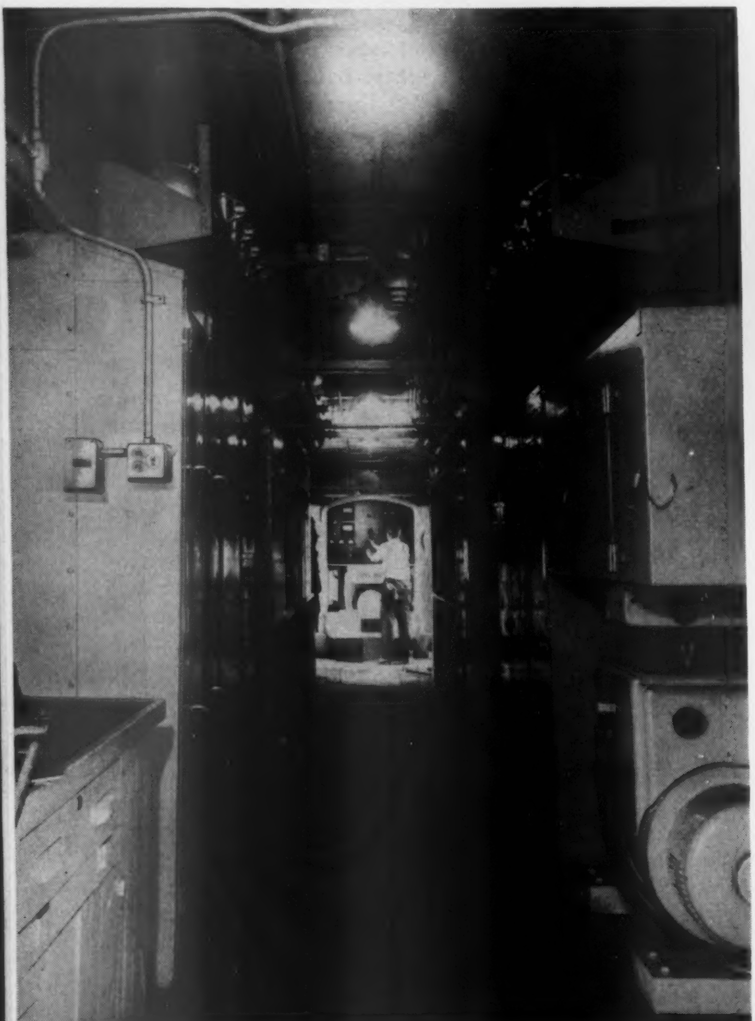
On engines equipped with an electro-hydraulic governor, the low-oil pressure engine stop button is set to trip at 3 to 5 lb. at idle and 14 to 16 lb. at maximum throttle, and 18 in. vacuum on the high oil-suction switch. When this button trips the engine should stop within two to three seconds if the throttle is open beyond the second notch. After the button has been closed and the engine started, trouble must be located within 40 seconds or the button will again trip, stopping the engine. The electro-hydraulic governor engine-stop button operates for both low oil pressure and high oil suction. The high oil suction portion also has a gauge located in the engine instrument panel which will indicate how much dirt has collected at the pressure-pump suction screens.

Q.—What does black smoke indicate?

A.—During routine inspection, care should be taken in observing for black smoke. Black smoke collecting under the engine head covers is an indication of defective parts, either a bearing running hot or a piston ring blowing by. Piston ring blow-by or a hot bearing (cracking the oil) will build up a pressure inside the crankcase oil pan. This pressure will force the black smoke upwards through the head drain pipes to under the crankcase head covers. For line of road operation, if at any time the pressure of the black smoke becomes great enough to raise the engine head covers, the engine should be stopped immediately and remain shut down until the point of despatchment is reached. Often a defective main bearing or connecting rod bearing will be indicated by black smoke blowing from the crankcase crankshaft holes as well as under the engine head covers.

ELECTRICAL SECTION

Chesapeake & Ohio Power Car



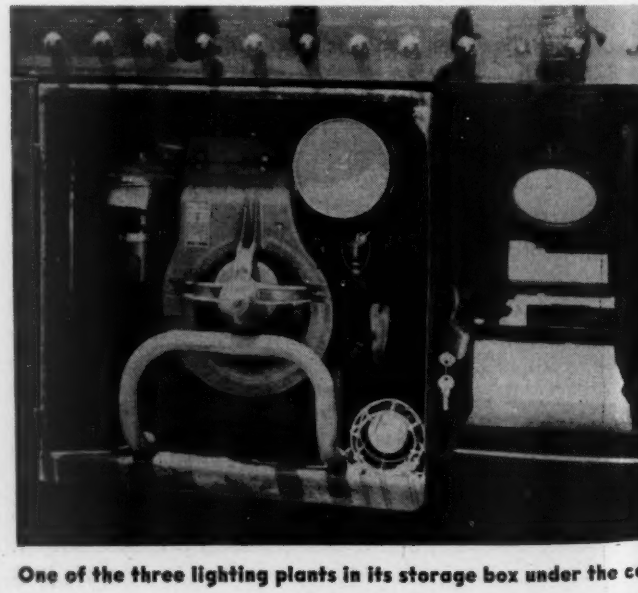
Interior view of the power car

C. & O. power car PC-100 showing end doors

Specially-equipped express car which may be moved in passenger trains supplies both a.c. and d.c. power at various voltages to meet all emergency requirements

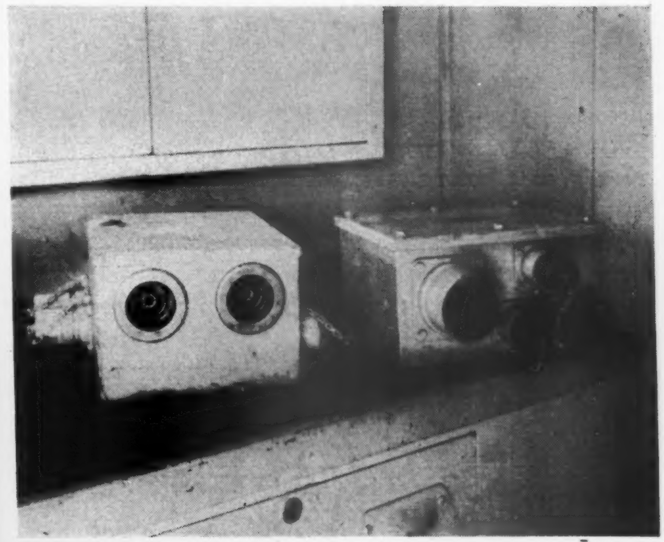
To meet an expanding need for a mobile electric power-generating facility, the Chesapeake & Ohio has placed in operation a power car designated No. PC-100. It is used as a source of electric power for the operation of air conditioning, battery charging and lighting equipment in cases involving parked special passenger trains, exhibits, etc., at locations not equipped with regular standby and battery charging facilities and at locations where such facilities are inadequate. It is also of great value as a temporary source of power for the operation of essential shop and terminal facilities in cases involving major repair, rebuilding, etc., of regular power supply lines, transformer substations, etc., and in various emergency situations. New uses continue to develop and the car is in use a large part of the time.

The generating equipment is housed in a converted express car which is suitable for movement at the head end of most special trains. Generating equipment consists of two Diesel-engine-driven, 3-phase, 60-cycle, 1,800 r.p.m. alternators, each of 100 kw. capacity. The alternators are star connected with the neutral brought out to the terminal board and are designed to deliver either 220 or 440 volts by changing strap connectors in a terminal box



One of the three lighting plants in its storage box under the car

Loading a cable reel into the car

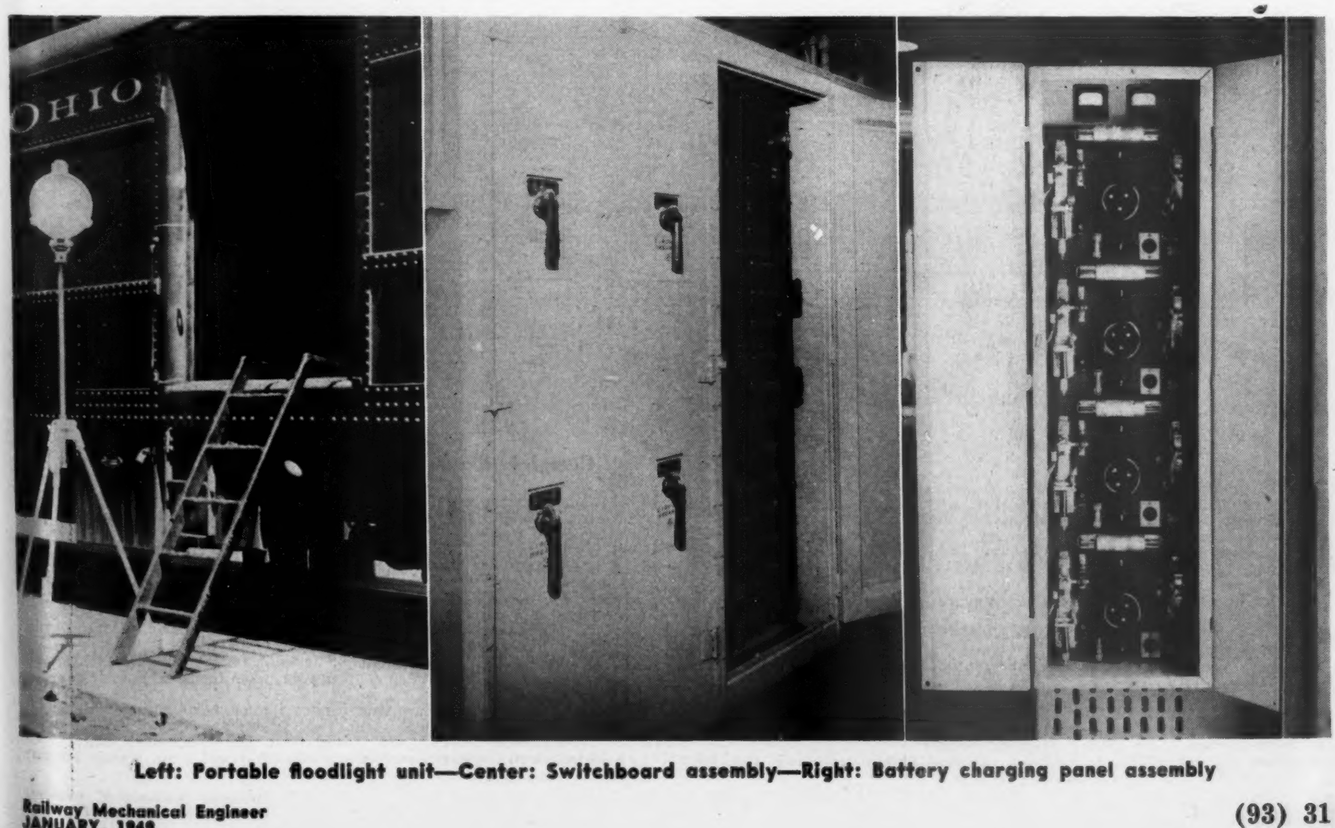


Portable connection boxes,—right, a.c. standby, and left, battery charging

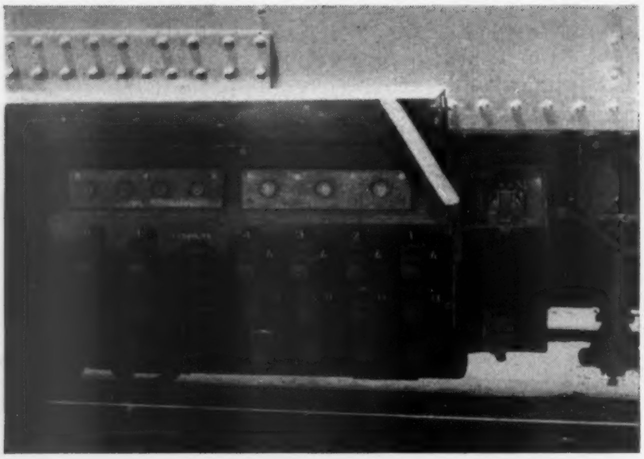
mounted on the side of each machine. Voltage to neutral is approximately 127 with the 220-volt connection and can be used for lighting. The machines can be operated singly, or in parallel, and each is equipped with a control panel containing synchronizing equipment, ammeters, voltmeter with transfer switch, wattmeter, circuit breaker, field switch, field rheostat, automatic voltage regulator unit, also, the starting switch, throttle and other engine controls. Current for operation of engine starting motors is supplied from the 32-volt car lighting battery. Fuel oil tanks for the Diesel engines are mounted under the car and have a total capacity of 385 gal. A tank of 75 gal. capacity is also mounted under the car for the storage of a supply of crank case oil. Water for filling engine cooling systems, etc., is carried in tanks mounted overhead in the car.

The engine-generator units are war surplus units acquired from the United States Government and are of a compact self-contained design intended for outdoor service. In mounting them in the power car, the weatherproof steel enclosure, starting battery and certain other apparatus with which the units were originally equipped, were removed to improve ventilation, accessibility, reduce weight, etc. The units are mounted one in each end of the car, with engine ends toward ends of the car, and the control panels facing the center. The car is fitted with double doors at both ends to permit removal of the engine-generator units for major repairs or other causes.

The wiring diagram shows all connections from the generator terminals to and between the various switches, circuit breakers, and other equipment in the car and a



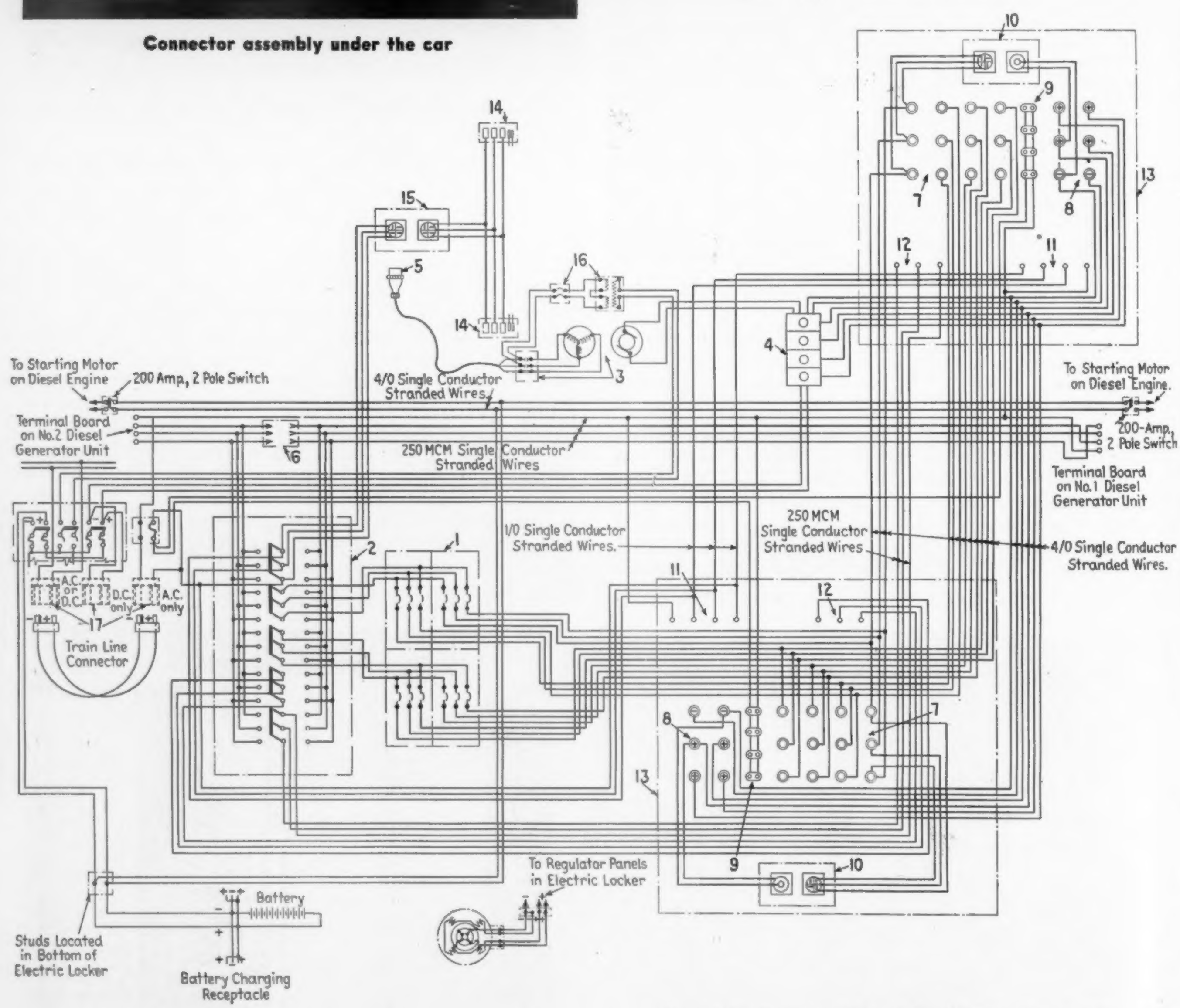
Left: Portable floodlight unit—Center: Switchboard assembly—Right: Battery charging panel assembly



Connector assembly under the car

description of the principal items. The five double-throw switches provide means of switching any of the four outgoing circuits and the circuit for battery charging machine and lights to either of the generators when they are operated singly. The isolator (item *5*) is normally open except when generators are operated in parallel. The switches, circuit breakers, etc., are of 600-volt rating so they may be used for either 220 or 440 volts. Items *7, 8, 9, 11* and *12* (connectors for outgoing power, lighting and battery charging cables) are mounted on a special terminal board assembly under the car with a duplicate assembly on the opposite side of the car for convenience. The connectors (items *7* and *8*) are used for the single conductor portable cables employed to distribute three-

(*Continued on page 37*)



Complete diagram of electrical circuits in the car

1—ITE type-KB, 400-amp., 600-volt, 60-cycle, 3-pole circuit breakers
2—Power distribution switchboard panel, with 3-pole, double-throw knife switches, 1—200-amp. and 4—400-amp., 500-volt a.c.
3—Battery charging motor-generator set, 70 volts, 300-amp., S-902A d.c. generator and 220/440 volt, 3-phase, 60-cycle, 78/39-amp., 30-hp. a.c. motor, 1,750 r.p.m. Serial No. FW 5683 motor-generator Corp., Troy, Ohio, with starter
4—Allen-Bradley 4-circuit battery charging panel, type L-12T10, 150 -amp. capacity
5—P.N. 4-pole, 3-wire, 60-amp. male plug, 220-volt a.c. connection for battery charger and lights
6—E.E.E. Co. 3-pole, 400-amp., 5,000-volt telescoping isolator, catalog no. 81016
7—Mines Equipment Co. single-conductor female connector insert, Cat. no. TCFIP-1-750 with cat. no. 1500 C 5 mounting shells, air conditioning circuits
8—Same as item 7, for battery charging circuits
9—Mines Equipment Co. 2-conductor, polarized female receptacle, Cat. no. 231-FR, for 115-volt a.c. lighting circuits
10—2-pole, 150-amp. standard car battery charging receptacle and 4-pole, 3-wire, 60-amp., 250-volt female receptacle, 220-volt power service, for servicing a single car each
11—4 ½-in. studs for 3-phase, 4-wire, 220/127 volts lighting service
12—3 ¾-in. studs for 3-phase, 3-wire, 220/440-volt power service
13—Special junction box with sloping face mounted under each side of car with item nos. 7, 8, 9, 10, 11 and 12 so mounted on face to make connections with portable cables simple
14—P. N. Co. 4-pole, 3-wire, 60-amp. air conditioning male car receptacle, mounted underneath on each side of car
15—P. N. Co. 4-pole, 3-wire, 60-amp., 250-volt female receptacles, 220-volt power connection for battery charging set, from inside or outside sources, mounted inside of car
16—2-kva., 220/32-volt, 1-phase transformer for a.c. car lighting with circuit breaker
17—P. N. Co. type TLRVT-200, 2-wire train line receptacles mounted on back of electric locker, for battery charging and train lining 110-volt a.c. service, for special requirements

Crosshead Induction Heater

The usually difficult process of removing piston rods from crossheads of steam locomotives is made relatively easy by the use of an induction heater developed in the Houston, Tex., shops of the Texas & New Orleans.

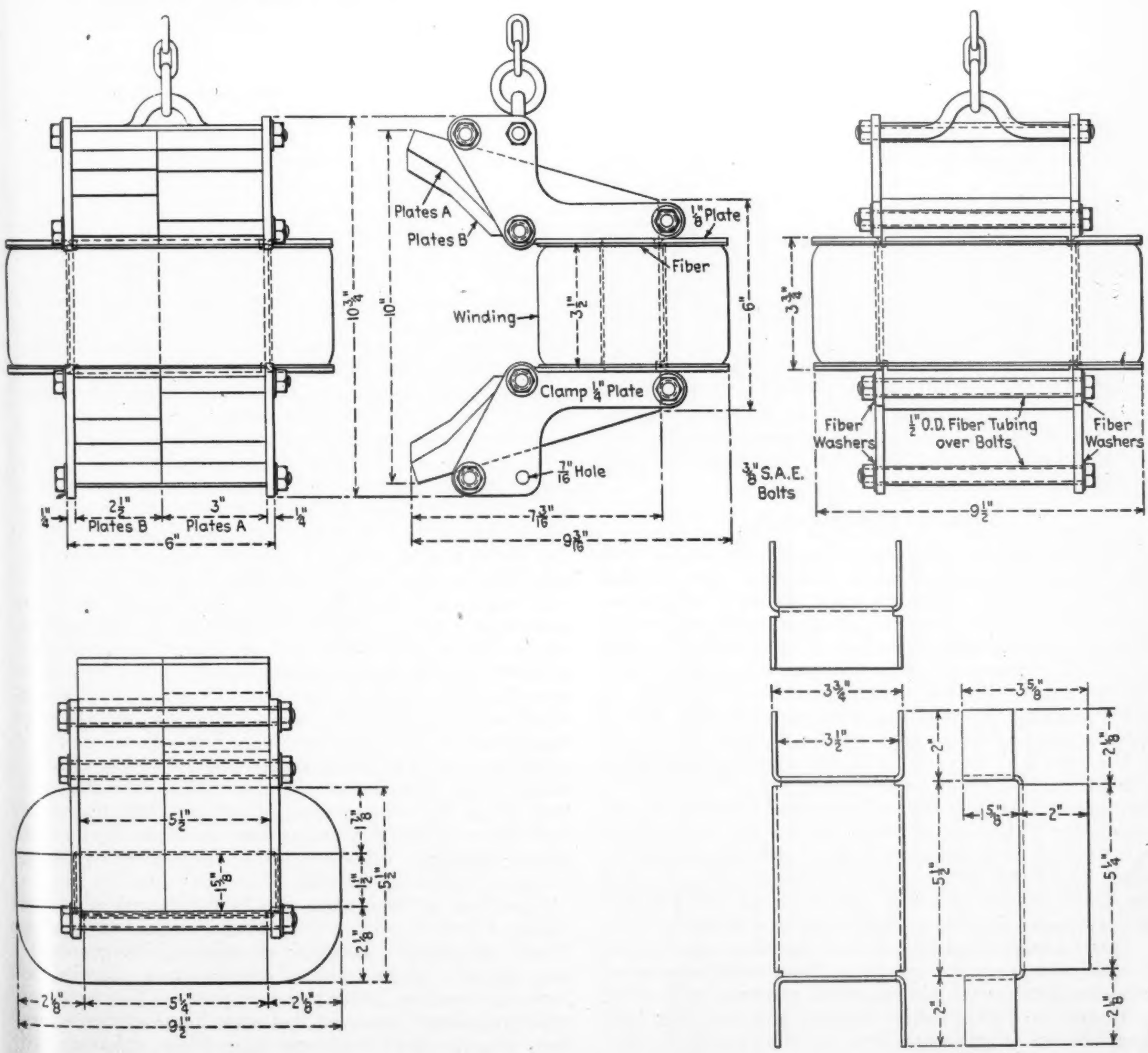
The device shown in the illustration has for its purpose the heating of the barrel or cylindrical portion of the crosshead; which portion has a taper fit and encompasses the end of the piston rod. The heat causes expansion of the barrel, facilitating the parting. In performing the operation, two units of the device are used, one placed on each side of the crosshead. A chain fastens the two units together and passes over the crosshead guide. The chain is adjustable and the two units are supported from the center of the chain, so that they are in contact with opposite sides of the crosshead. By shortening or lengthening the chain, they can be made to lie properly against the crosshead barrel. The units are energized by 220-volt, 3-phase, 60-cycle power.

The device consists of a laminated core of transformer iron and a winding of magnet wire around the core. The sheets or plates of the core are so shaped that they permit the wire to be wound around its central portion. Where convenient, it is recessed to hold the winding. Where the winding is not supported by this recess, it is held in shape by a form.

The shape of the plates at the portion where the core comes in contact with the barrel of the crosshead is so chosen that it fits the collar and neck of the barrel, as near as is practicable. For this reason, two shapes of plates are used. The device is used with several sizes of crossheads, and the contour of the plates is made to approximate the shape of all of them.

The device works on the principle that the energized winding sets up magnetic lines of forces in the iron path, consisting of the core of the device, and the barrel of

(*Continued on page 37*)



Form for Winding. Material - Steel Plate

One of the two units used to expand crossheads

Selecting Caboose Power Supply

By E. H. Musgrove*

Potentialities of different types are indicated by performance and cost records developed on the D. & R. G. W.

RADIO communication in freight train service has been generally accepted as an improvement of considerable importance. This includes wayside communication with freight trains, between freight trains, and between the engines and cabooses of freight trains. Modern radio techniques have solved the problem of voice communication, but until recently a principal difficulty has been that of a dependable source of power for the caboose unit.

We have made a rather intensive study of this problem as it appears on the Rio Grande, and find that under our conditions a standard 1,200 r.p.m., single-cylinder, Diesel-driven generator unit affords a dependable, satisfactory, and economical source of power for caboose radio communication.

Under present conditions, there are two basic types of power supply for caboose radio equipment: (1) internal combustion engine-driven equipment (including Diesel engines), and (2) storage batteries. The most important consideration is the ability of the power source to deliver dependable power at all times. Operating problems are ordinarily next, while maintenance comes third, and costs last.

Many factors are involved in achieving dependable service. It is necessary to have power equipment that will withstand all the adverse conditions to which it will be subjected, such as changes in temperature, altitude and humidity, dirt, dust, sand, snow, rain, vibration, shock and load variation. The power source must be capable of delivering uniform and dependable power regardless of whether the train is moving fast or slow, or standing still for long periods. It must be capable of operating for long periods without attention by skilled workmen. Internal combustion engines must be easy to start under all conditions, and must be free from fumes and fire hazards.

Types of Power Supply

Gasoline engines offer many advantages, but the item of fire hazard is considered as being too great by most railroad insurance companies and many cities, which precludes their use at present. Propane units are considered as being safer than gasoline engines, but not as safe as Diesel engines, although this question has not been finally settled. Radical changes in altitude are likely to affect propane engines unfavorably, and difficulties in cold weather starting are as yet a serious problem.

We have had, however, a Diesel engine-driven generator in service 24 hours a day for nearly two years without any serious difficulty. The engine operated continuously for 10,050 hours before it gave any trouble, and after it had been repaired it has continued to run for more than 5,000 hours. The fire underwriters consider the Diesel engine as being more of a fire hazard than battery power, but safer than propane or gasoline.

Our experience has been that the heavier, water-cooled Diesel units are more satisfactory and more economical in operation than the air-cooled gas-powered units when subjected to high ambient temperatures, and we have been able to solve the problem of vibration by a careful choice of vibration dampeners.

Battery power, at first glance, appears to offer many advantages, particularly as it has given satisfactory results on passenger equipment. Freight service, however, is far more severe and axle-driven equipment has not stood up too well in service. Similarly, batteries are subject to conditions in freight service that are not encountered in passenger service, such as severe shock and long exposure to low temperatures without charging.

Equipment Performance

When we began experimenting with radio in 1945, we were anxious to determine what maintenance would be required. Records show that at first we could keep radio equipment in operation on Diesel locomotives for about eight days before a failure developed. Propane engine equipped cabooses averaged about two weeks, and the one Diesel engine equipped caboose operated continuously for five weeks before failure. After about four months, we had been able to improve the radio equipment to such a point that we were able to average 27 days on locomotive equipment, 40 days on the propane engine cabooses, and 92 days on the Diesel engine-equipped caboose.

Still more modern equipment was installed early in 1947, and we now find that all radio equipment in the locomotives can be depended upon to operate more than two months; propane engine equipped cabooses two and one-half to three months; and indefinitely in the case of the Diesel engine equipped caboose, since no failure occurred in nearly a year of operation.

Voltage regulation plays an important part in radio maintenance costs. Charts showed us that the propane engine driven generators gave a voltage regulation of $\pm$ 6 per cent fluctuating approximately once every three seconds above or below the mean 115 volts. In the case of the Diesel engine driven generator, the voltage regulation held to $\pm$ 1.5 per cent with fluctuations occurring approximately once every 15 seconds. The Diesel locomotives use 64-volt batteries for power and fluctuate from 64 to 78 volts, or plus 22 per cent with no minus fluctuation below 64 volts. Other railroads report that battery-equipped cabooses show fluctuations ranging from $\pm$ 18 to $\pm$ 21 per cent.

Operating practice must also be considered when selecting a power source for caboose radio equipment. When cabooses are assigned, all units subject to operation behind a radio-equipped engine must likewise be radio-equipped to protect the engine. The personnel problem makes it essential that something be done to reduce vibration and overcome noise where cabooses are used for sleeping between runs.

A railroad that uses assigned cabooses has the best

*Radio Engineer, Denver & Rio Grande Western.

chance to keep batteries charged by terminal charging when necessary. On the other hand, however, roads that pool their cabooses usually run them nearly continuously. Should a battery be down, there is little chance of getting it charged at a terminal unless the caboose is bad-ordered and removed from service. Another bad feature of the pooled caboose system is the natural tendency to be lax in the proper rotation of units, so necessary for maintenance purposes. This will have to be overcome in matching radio-equipped cabooses with radio-equipped engines and special facilities will have to be established for servicing and repairing the radio and power equipment. Similarly, procedures must be established for the switching and handling of radio-equipped cabooses by the yard forces.

One advantage that the pooled caboose has over the assigned is that radio installations can be made in pairs, thus holding the initial expenditure for equipment and installation to a minimum.

Experience accumulated on the Rio Grande shows that the small high-speed, air-cooled engine generator units require far too much servicing and maintenance to justify their lower initial cost. We find that because of the fewer servicings required on the Diesel engine unit we can establish a single service point, which means that all education, supervision, personnel, parts and supplies can be concentrated. Also, handling fuel oil is much easier than handling propane gas bottles. Under our system of servicing the Diesel engine equipped caboose, we have found that the engine was inoperative 0.2 per cent of the train miles, whereas in spite of all the additional servicing and checking, the propane engines were inoperative an average of 8 per cent of the train miles.

Costs

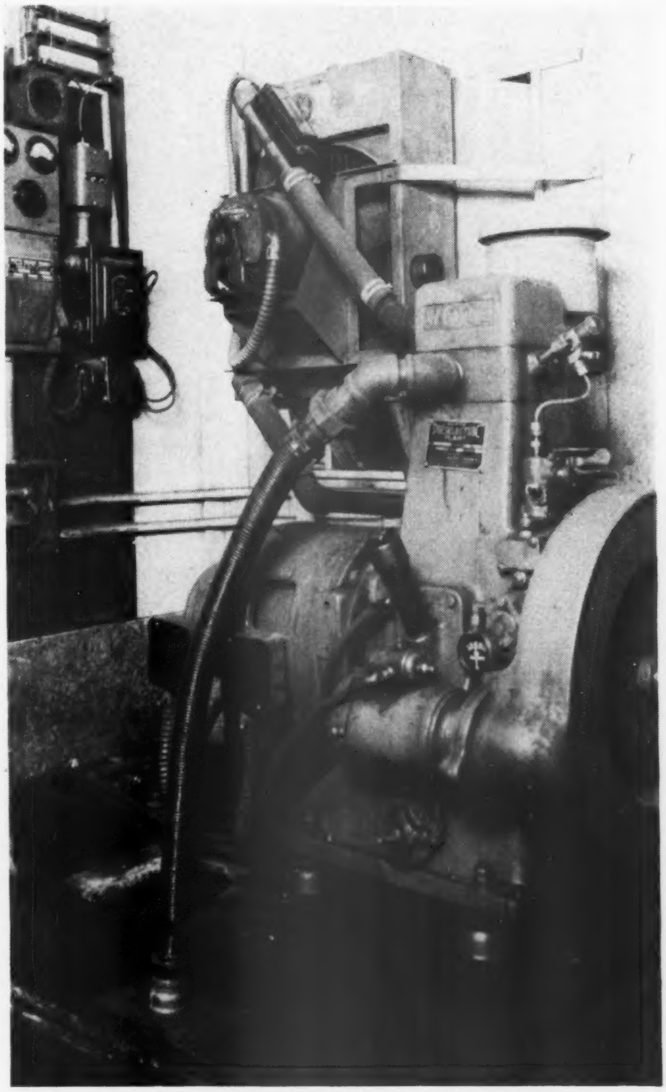
Three items of cost must be considered when selecting caboose power units. These are initial, or purchase cost, installation cost, and maintenance cost. Initial cost for a propane engine-driven generator is around $500. Installation costs will amount to about $300, making a total of $800. A Diesel engine-driven generator such as we have on the Rio Grande will cost about $1,400, and can be installed for about $100, or $1,500 for the unit installed. An axle-driven generator battery unit will cost in the neighborhood of $1,500 with an additional $1,300 for batteries and $400 for installation, or about $3,200 for the unit ready for use.

Maintenance and servicing of a propane engine unit will cost around $300 a year, while its oil and gas fuel will amount to about $465. The necessary monthly overhaul will involve labor costs of at least $425, plus materials, amounting to about $420. Thus the total cost for servicing and maintenance will reach $1,600 per year, or more than three times the original cost of the unit.

A single-cylinder, water-cooled, 1,200 r.p.m. Diesel engine-driven generator set such as we use can be serviced forty times a year for a total labor expenditure of $125. Oil and fuel will only cost about $70, and the engine can be overhauled for about $35, with around a $70 expenditure for parts. Thus service and maintenance will amount to only $300 per year, or about 20 per cent of the original cost. Battery unit costs are reported to amount to about 16 per cent of the original investment.

From the standpoint of reliability and over-all dependability, the axle-driven generator battery and water-cooled Diesel engine-driven generator systems are comparable. The longer life expectancy of the battery system makes it comparable in terms of over-all cost with the Diesel unit.

The determining factor as to which kind of caboose power supply should be purchased will in most instances be closely tied into the operating problems involved on the individual road. In any case, it should be remembered that the initial cost of the power equipment is minimized when the cost of servicing and maintaining both the power supply and the radio equipment is considered. Also, in the long run, the advantages derived from radio communication with and between trains, and between engines and cabooses, will soon make any reasonable expenditure for the necessary equipment seem practically negligible.



A Diesel engine generator power unit as installed in a D. & R. G. W. radio-equipped caboose—The control panel is shown at the left, and the jacket water radiator and fan is shown behind the engine

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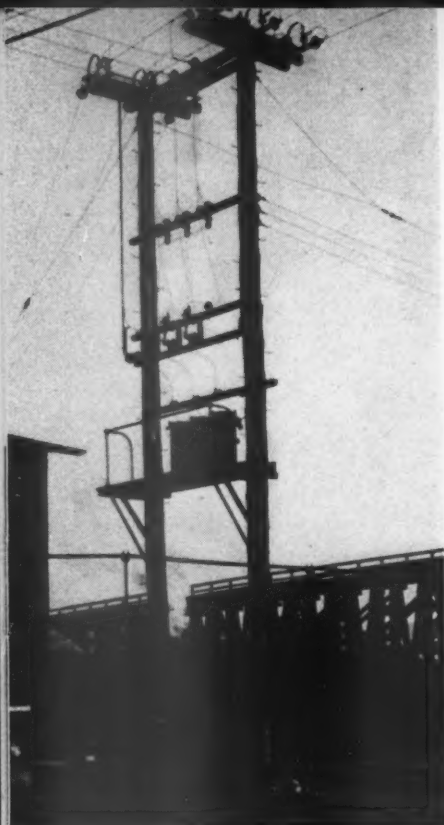
In the Vernacular.—The little red car that tags along behind each day's 24,000 freight trains in the United States is generally known as the caboose. The December 25, 1948 issue of Saturday Evening Post lists the following railroad men's names for this car: The ambulance, anchor, ape wagon, brain cage, bed house, bird cage, bouncer, bone breaker, baby's wagon, buggy, bazoo wagon, cabin, chariot, crib, cripples' home, cigar box, clown wagon, den, doghouse, diner, glory wagon, go-car, hash hut, hack, hay wagon, hearse, jailhouse, kitchen, madhouse, monkey hut, monkey buggy, palace, parlot, perambulator, rest room, rough rider, shack, shanty, van, way car.



CONSULTING DEPARTMENT

Can you answer the following questions? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

What effect does commutator condition have on brush performance?

Good lighting depends upon a good installation that is adequately maintained. Can you suggest some way of encouraging railroad users to keep their lighting systems in good condition?

Care of Trans- formers

What kind of care and attention is required by power transformers? Is it the same for small pole-mounted units as it is for those in vaults or on platforms?

Proper Overhaul Procedure Will Insure Long Transformer Life

Let us assume that a demand survey has shown the necessity of re-designing the layout of a railroad yard, changing the load centers, installation of a few banks of larger transformers and re-location of existing transformers if found suitable for further use.

This will provide sufficient time to overhaul and test these spares before re-location and will well pay for the time and material involved in continuous performance and satisfactory operation.

When these transformers reach the shop, the oil should be sampled, but not too soon after the transformers have been handled as the oil should settle and about half of a gallon allowed to drain out before the amount taken for testing is secured. This sample, about a quart, should be taken in a clean can or glass jar with a tight cover and should be tagged with the identifying mark from the transformer it is removed from. The local power company has facilities for making these hi-pot tests of transformer oil, and will usually perform the tests for a nominal sum. If the oil indicates that it can be re-used after filtering or is satisfactory to re-use, it should be dumped in a clean container and either filtered or saved for re-use. Small quantities of transil oil, say 25 gal. or less scarcely are worth trying to re-claim, as the cost of handling is as much as the price of new clean oil, but if much oil can be salvaged, it is good practice to have the power company filter it for you.

The cost of a testing cup and transformer and of a blotter type filter will make their purchase impracticable, unless the cost can be divided among the power and signal department transformers on a large system.

The core and winding is next removed from the case and the primary and secondary leads disconnected from the winding. The accumulated sludge in the core and winding should be washed out with a combination air and mineral spirit jet so that all sludge is cleared out from oil circulation ducts in the core assembly. After cleaning, the windings should be baked for at least eight hours at 250 deg. F., and after baking it is good practice to megger the windings both to ground and between primary and secondary windings. This reading should be taken after the core and winding has cooled to room temperature and should be at least five megohms for transformers in the smaller size ranges.

If a satisfactory reading is obtained, the cooled core and windings should be dipped in a good grade of oil-resistant baking varnish and allowed to drain and air dry before baking. This varnish should be thinned to the lowest viscosity recommended by the manufacturers, as it must penetrate all parts of the winding and core yet not be so thick that it clogs the ventilating ducts and reduces the natural circulation of cooling oil.

After air drying until it has completely ceased draining, the core and winding should be again baked for the maximum time recommended by the varnish manufacturer. This usually is from 12 to 16 hours at 250 deg. F. Infra-red ray lamp ovens seem to be entirely satisfactory for this class of baking and will provide a high enough temperature for most grades of baking varnish.

After baking, the windings should be allowed to cool to room temperature and given a hi-pot test of 2 times normal plus 1,000 volts to ground and normal voltage plus 1,000 volts hi-pot from primary to secondary winding. In a 4,160-volt Y connected installation, the voltage to ground (2,300) should be used in calculating the test voltage, both to ground and between windings.

While the core and windings are being treated and during the period of baking, the transformer case should be washed out, and inspected for rust spots and leaks. The interior should be painted with oil resistant paint and the exterior painted with metal primer, and weather resistant paint. The threads in the drain connections should be clean, and the plug tightened with joint compound to prevent oil leaks.

The primary and secondary leads should be renewed, using an extra flexible cable with weatherproof braid of sufficient size to carry the expected load of the transformer, taking into consideration that the permissible overloads run up to 150 per cent for short periods of time. If the insulation is cut back about an inch and the end of the cable dipped into a pot of hot solder before connecting to the windings, it will help prevent oil from syphoning out by way of the leads and insulation. The porcelain bushings must be cleaned and inspected and if cracked, they must be replaced. The manufacturers recommended compound (not pothead compound) should be used around bushings and leads. By tipping the case before pouring until the flat portion of the bushing is level, a more satisfactory job is made. The bushing

compound should be heated to as near the manufacturers' recommendations as possible with the facilities available.

The core and winding may then be replaced in the case and bolted down securely. The next operation consists of making the primary and secondary connections. A final hi-pot before adding oil will provide a check on clearances of leads to case or core, and corrections can be made before oil is added. The transformer case is then filled with new or reclaimed oil up to the oil level stamped on the inside of the tank. If a cover gasket is not available, a strip of ⅜-in. hair felt, cemented to the gasket groove in the cover, can be substituted.

With this treatment, a transformer can be expected to take on a new lease on life and serve many years of use and abuse before reaching the scrap pile.

This schedule of treatment is applicable to transformers up to about 25 kva., but may also be limited by the material handling facilities of the shop, and the length of time the transformer can be held out of service.

Large power banks should have the oil periodically sampled and records kept of the results of each year's tests, and when test shows it to be necessary, the oil can be filtered in place using a portable filter press, drawing the oil from the bottom of the tank, through the filter press and discharging it into the tap changing manhole in the transformer cover. This cycle is repeated until a sample caught from the bottom line tests satisfactory in the testing cup. This oil test and filtering combined with spot painting of rust spots as they are discovered is about all the care and attention that a vault type or platform-mounted bank can be given.

Considering economy of operation, it is good practice to check demand on large power banks as gradual changes in shop facilities may leave a heavy duty power bank carrying a light load and eating its head off on core loss, while at some other plant or location the life of a smaller bank of transformers is being shortened by continuous overload. In some cases, both faults can be corrected by interchanging the two banks.

Recording demand meters, or watt meters, are an investment that can result in large savings in power bills if proper advantage is taken of the results indicated by their use.

FRED A. TOTAMS
Electrician,
Florida East Coast Railway

Chesapeake & Ohio Power Car

(*Continued from page* 32)

phase, a.c. power and d.c. battery charging current to parked passenger cars or in similar situations. Terminal studs (items *11* and *12*) facilitate connecting the entire output of the power car into a distribution system such as when providing emergency electric supply for a shop or terminal facility. The receptacle (item *10*) assembly permits serving small loads, such as a single parked car, where conditions permit, without using the heavy single conductor cables. The connectors (item *17*) provide means of battery charging through regular train lines and of transmitting a.c. current through the train line when occasion requires. The receptacle assembly (item *15*) permits operation of the battery charging machine from an external 220-volt, three-phase, a.c. standby source in cases where such is available and battery charging service only is required. Battery charging connectors (items *1* and *2*) bearing minus signs are common return circuits connecting direct to the generator negative while those numbered *1, 2, 3* and *4*, bearing plus signs, are single wire positive circuits, one from each of the four battery charging panels.

Portable cables carried in the power car include thirty-nine single conductor No. 4/0 cables, 160 ft. long, with appropriate single-pole connectors at each end. They are used interchangeably to provide three-phase a.c. or d.c. battery charging feeder runs to and alongside parked cars, etc. There are also twenty standard 50-ft., three-conductor, portable standby cables and twelve standard two-conductor portable charging cables. Twelve a.c. connection boxes of the type shown at the right, and three battery charging boxes of the type shown at the left in one of the illustrations are carried on the car. These have connections on both sides for the feeder cables and outlets for plugging in two standard portable cables, and are usually placed at intervals of two car lengths when in use. A special steel reel, similar to a hose reel, provided for each of the No. 4/0, 160-ft., single-conductor cables, greatly facilitates the handling and storage of these cables.

Three 800-watt, 115-volt a.c., gasoline-driven, portable lighting plants and a supply of 200-watt tripod-mounted floodlights with an assortment of portable cables are included in the car's equipment to meet varying needs for lighting around parked cars, exhibits, work areas, etc. The lighting plants are stored in steel boxes mounted under the car.

The photograph of the car interior shows, at the left, work bench, switchboard assembly, electric locker, space for access to rear of switchboard, storage bins for cables, connectors, etc. At the right are battery charging m.g. set with supply outlets and miscellaneous storage locker above, clothes locker, toilet, shower bath, wash basin in alcove, storage bins for cables and connectors. At the center, is one of the Diesel-generator units. Above are floodlight storage racks and water tanks.

Crosshead Induction Heater

(*Continued from page* 33)

the crosshead. These lines of force cause little heating in the laminated core, but much in the unlaminated barrel due to induced eddy currents. Also, due to what is known as skin effect, the eddy currents are confined largely to the outer rim of the barrel. The greater density of eddy currents in the barrel, as compared with the piston rod, give a greater heating effect and, consequently, a differential in the expansion of the two elements. This tends to separate the two elements at the fit between them, thereby making parting easier.

The laminated sections on both sides of the B plates and on one side of the A plates, for a thickness of 3/16 in., are made of sheets .045 in. thick. All other plates are .022 in. thick. The winding consists of two No. 6, asbestos-covered magnet wires in parallel. The winding is protected by sheet fiber .03 in. thick. Connection to the power outlet is made by a four-conductor, type S, portable cable, the fourth wire serving as a ground connection. The current is normally held on for a period of five minutes before the rod is pulled.

NEW DEVICES

Packaged Power for Cabooses

The R. H. Sheppard Company, Inc., Hanover, Pa., has announced a packaged unit which features its model 14, 1-cylinder air-cooled Diesel engine connected to a 2 000-watt generating set. The new unit is designed as a generator set for railroad caboose communications and work car power supply. The engine and generator is mounted on vibration isolators and a common base of ½-in. steel plate; the entire unit is housed in a heat-proof and sound-proof enclosure which measures 22 in. wide, 38 in. deep and 39½ in. high. The unit is available as an alternating current generator or a battery charging set. The width has been held to 22 in. so that the unit will pass through the door of a caboose. The length, 38 in., should permit its placement without its encroaching on the aisle space. The height allows it to be set below a window.

All cooling ducts are built into the unit, and a crankshaft ventilating fan is provided so that the unit may be set against an opening in the side of the car 18 in. wide and 38 in. high. This one opening serves both the intake and exhaust apertures in the unit.

An inlet air filter to keep the engine clean, and the louvered section may be mounted either on the unit or on the outside of the car.

The exhaust muffler has a connection for piping either to the roof or under the car. Starting batteries are included in the enclosure. Starting and stopping of the engine is accomplished by a toggle switch and starter button on exterior of the instrument panel.

The instrument panel is mounted on the face of the unit. Power is available from receptacles, and power circuits are protected by circuit breakers. A hydraulic throttle provides low lubricating oil pressure protection.

The top and front panels of the enclosure are hinged for easy access, and the side panels may be easily removed if required. There is an auxiliary ventilating fan mounted on the crankshaft to keep the interior of enclosure cool. An electric pump, with flexible fuel lines for filling the fuel tank, is available for mounting under the car.

Lifetime Journal Box Lid

Less out-of-service time for freight cars and substantial savings in maintenance costs are offered through the use of a journal box lid claimed never to need replacement by its manufacturer, American Locomotive Company's Railway Steel Spring Division, Latrobe, Pa. Known as the Alcolid and certified by the A. A. R., this product is designed to eliminate the entrance of impurities into the journal box as a result of loose or ill-fitting lids. There is no hood to come off, and no eyes to break off; pin-hole elongation or binding of the lug cam are said to be impossible.

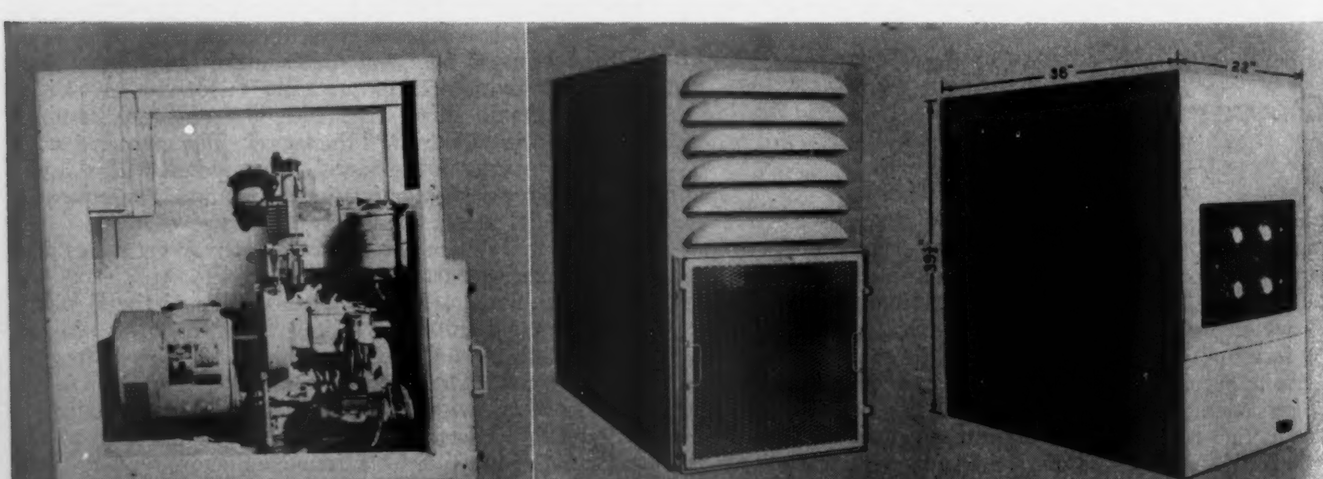
After the holes in the Alcolid are aligned with the holes in the box, and the retaining pin is inserted, the lid is pushed down to put the spring under pressure, and the shipping pin is withdrawn and discarded—In the final step, a tab is bent over the square head of the assembly pin to lock the pin against longitudinal movement and to prevent rotation and elongation of the pin holes

Installation of the Alcolid can be made to new or old cars and is performed in three steps. The holes in the lid are aligned with holes in the box, and the retaining pin is inserted. The second step is to push the lid down enough to put the spring under pressure and then withdraw the shipping pin, which is discarded. The third and final step is to push the lid all the way down and bend the flanged hood ear in place.

Once installed, the Alcolid is said to be free of any vibration problem. A torsional spring exerting a 50-lb. pressure keeps the lid permanently sealed against the box face. The square-headed retaining pin is held securely in place by a flanged hood ear bent over the pin head. Locked against longitudinal movement, the pin cannot rotate, and becomes an integral part of the lid. A feature of the lid is the roller mounted on the lid spring which forms a roller bearing to aid in easy opening and to prevent wear and consequent binding on the lug cam of the journal box.

Water Cooler For Diesel Locomotives

Developed specifically for use in Diesel locomotive cabs, the Marquette water cooler is a complete unit package that requires only a waste water outlet, a source of electric power and bolting to the floor to have cold water available within three minutes. The cooler is 9¾ in. wide, 13¾ in. deep and 33 in. from the floor to the top of the cabinet. It delivers 3½ gal. of water per hour at



Left: Arrangement of apparatus inside the cabinet—Right: Front and rear views of the power unit housing

The Marquette water cooler for use on Diesel locomotives is 9¾ in. wide, 13¾ in. deep and 33 in. high

50 deg. F. under conditions normally encountered in a locomotive cab.

The cooler has a stainless steel water guard and alcove, copper tubing and a large condenser and motor. For servicing, the removal of four screws permits the side panel of the cooler to be slipped off and makes all working parts immediately available.

The water cooler is manufactured by the Marquette Railway Supply Company, 332 South Michigan avenue, Chicago 4.

Duplex Fuel Filter

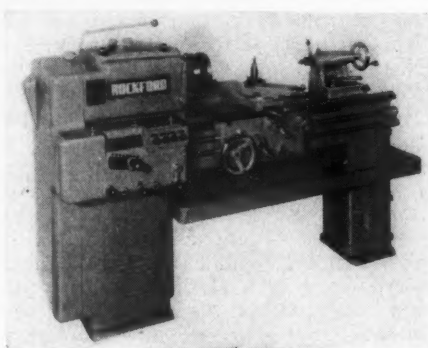
A duplex filter trade-named Micro-Klean has been designed especially for Diesel-engine fuel service by The Cuno Engineering Corporation, Meriden, Conn. The filter has a special three-way changeover valve in the head, allowing operation of either half separately or both together, and is suitable for engines from 500 hp. to 2,000 hp.

The Cuno Micro-Klean duplex filter

Pipe connections are placed in the center of the unit so that the filter can be mounted on either the right or left side. Sufficient room is provided between inlet and outlet connections to swing a street elbow in one connection after a straight tube fitting is in place in the other.

General Purpose Lathe

A medium-size, general-purpose engine lathe with an all-geared headstock and a range of 12 spindle speeds has been introduced by the Rockford Machine Tool Company, Rockford, Ill. The spindle has been made from a high-alloy steel forging and is mounted on Timken zero-precision bearings. The spindle nose has a No. 1 tapered key drive. Headstock gears are cut from pre-heat-treated steel gear blanks. Positive gear lubrication is attained by an immersion and oil-splash system.



The Rockford 14-in. engine lathe

The overall design of the headstock permits all types of lathe operations, including high spindle speeds and the use of Tungsten carbide cutting tools. All moving parts, with the exception of the spindle nose, are protected as a safety measure for the operator. Pickoff change gears, reverse gears, V-belts and similar parts and assemblies are accessible for adjustment or repair through the hinged door on the headstock end of the lathe.

General Purpose Floodlights

Two general purpose floodlights, designed for small area lighting, have been announced by the Lighting and Rectifier Division of the General Electric Company. They are the type L-82, rated at 300/500 watts, and the type L-83, rated at 750/1,000 watts. A tightly sealed hinged door, which is locked by three clamping lugs, replaces the clamped ring on older types. A new aluminum reflector designed for higher beam efficiency in accordance with N.E.M.A. standards, and a locking handle on the elevation adjustment which eliminates the need for using wrenches, are features of the new lights.

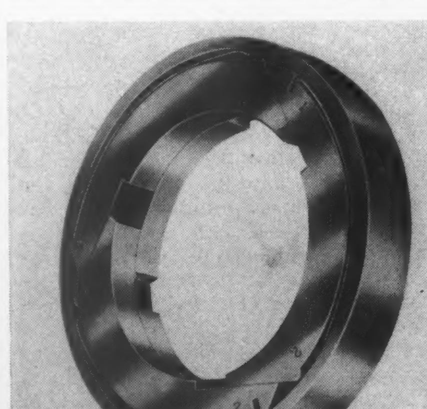
An L-82 floodlight with a portable base

Both units can be provided with a portable base as well as the slip fitter and pipe clamp mountings. The portable base, which measures 14⅛ in. in diameter, is made of steel with a hot-dip galvanized finish.

Piston Rod Packing

Everseal metallic piston-rod packing has a patented construction designed for uniform wear. The six interlocking segments are held in place by three pins, located for equal load distribution. A light spring compression, only 50 to 60 lb. recommended, is used to lengthen packing life and give more economical overall operation.

Everseal packing in all sizes to accommodate rods from locomotive piston rod size down to ½ in. in diameter is made by the Spring Packing Corporation, 122 South Michigan avenue, Chicago. The packing itself is largely interchangeable with that of other makes and uses the conventional stuffing-box

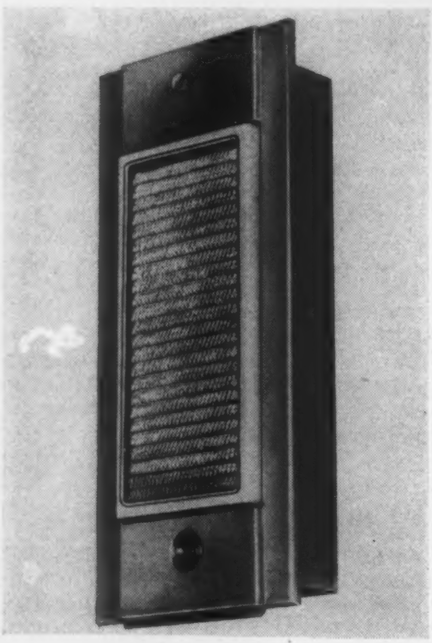


Everseal metallic packing is made in sizes from ½ in. to locomotive piston rod diameter

gland. One boring chuck, available from the manufacturer, handles all sizes of packing.

Fluorescent Berth Light

Improved lighting comfort in sleeping car berths is now being offered through the use of a new berth light by Luminator, Inc., Chicago, Ill. The fixture employs fluorescent lighting, with Prismolens glassware, to permit the light to be controlled in one direction without glare or excessive



Luminator berth light with prismatic light control

brightness, while permitting the maximum amount of light in the other direction. The unit is built around a new 12-in., 13-watt fluorescent tube and may be operated on either 64 volts d.c. or 110 volts a.c. Provision is made for regular blue night light use.

Dial-Type Milling Machines

A dial-type milling machine is now being manufactured by Cincinnati Milling & Grinding Machines, Inc., Cincinnati, 9, Ohio, in medium and high-speed ranges, and in plain, universal and vertical styles, Nos. 2, 3 and 4 sizes for each, or a total of eighteen different machines.

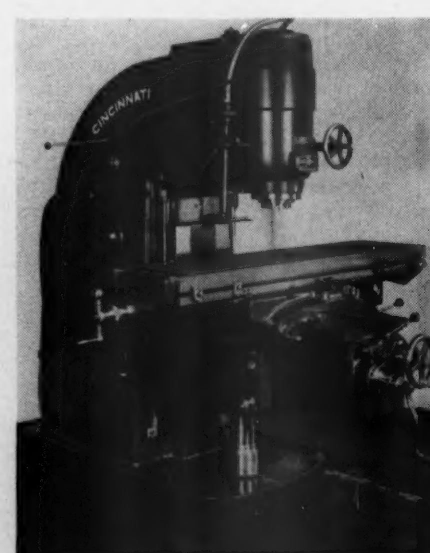
Like earlier dial types, these machines have power speed and feed change, operable with a single two-position lever at the front control position or a similar lever at the left-hand side of the column. The machine performs the actual work of shifting gears. While the operator holds the lever in the speed or feed change position, the speed or feed dial, as the case may be, clicks around, and, upon release of the lever, the proper gears are in mesh for the speed and feed indicated. This feature permits rough

The Cincinnati plain high-speed dial-type milling machine

and finish cuts to be made or cutters to be changed while the part remains in the fixture or on the table.

High-speed machines have 21 spindle speeds from 20 to 1,500 r.p.m. for the No. 2 size and 18 to 1,300 r.p.m. for the Nos. 3 and 4 sizes. Twenty-four feeds cover a range of 5/16 to 60 in. per min. Medium-speed machines have a slightly smaller selection of speeds and feeds, and the upper limits are one-third those for the high-speed machines. Feed and rapid traverse control levers are independent and directional, and fitted with plastic knobs. Rapid traverse to the table —cross and vertical slides, 100 in. per min., and 100 and 80 in. per min., respectively—is engaged in conjunction with the rapid traverse lever and the feed engaging levers.

Vertical dial-type machines have hydraulic counterbalance for the vertical heads. All are equipped with built-in vibration damping units—in the overarm of horizontal machines and in the vertical head of vertical machines. Lubrication is largely automatic. All parts with-



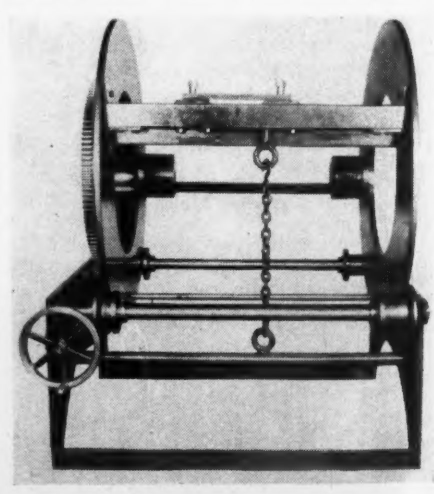
A vertical high-speed dial-type milling machine built by Cincinnati Milling & Grinding Machines, Inc.

in the column are lubricated by a pump and splash system. Parts within the knee are lubricated by a similar system. Saddle, housing and table parts are lubricated from a built-in manually operated plunger pump. The vertical feed screw operates in oil supplied from an individual reservoir. The coolant system returns the cutting fluid to the reservoir in the base. Through cored openings in the table, saddle and knee the coolant flows to the space between two sets of telescopic tubing, one within the other.

Standard equipment includes motors and controls with all styles of these machines. In addition, vertical machines are equipped with power feed and rapid traverse to the vertical head, and a four-position, dial-indicated turret stop. Like other power feed units, the vertical head has 16 and 24 different feeds, for the medium-speed and high-speed dial types, respectively. Feeds range from 5/16 to 8 in. per min., and 1/8 to 24 in. per min., while the rapid traverse rate is 40 in. per min. for both.

Holding Stand For Traction Motor Frames

The Peerless stator stand for holding the stator, or frame, of a traction motor is mounted on a welded base which supports a rotating member constructed to hold and position the stator. After the motor is disassembled, the stator is lowered into the stand with a crane and



The Peerless traction motor stator stand

clamped to the framework of the stand with a mounting lug. Various types of stators may require some slight adjustments or modifications, but these can be incorporated for any of the existing types of Diesel traction motors now operating.

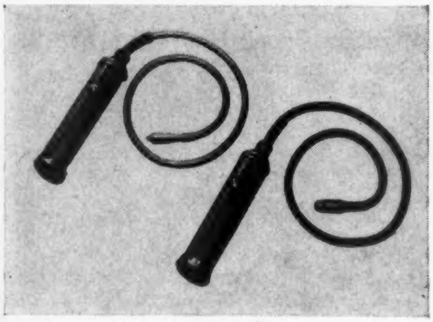
The entire stator and the frame is rotated as a unit on the base by a handwheel. Motion is transmitted by a self-locking worm and gear to a large gear mounted on the front of the main supporting ring. To reduce the effort required to rotate the stator, the worm and its gear are enclosed in a housing and operate in oil, and the roller supports for the large rings are equipped with anti-friction bearings.

A chain and hook are connected between the rotating member and the base. This is a safety device used during the installation of the stator. It serves as a means of positioning the stator holder and lessening the danger of shock which might occur to the main ring gear during the installation of the stator itself.

This holding and positioning stand for traction motors is a product of the Electric Service Manufacturing Company, 1739 Cambria street, Philadelphia 32, Pa.

Flashlights with Flexible Extensions

To permit the use of Flex-Lite flashlights under practically all working conditions, they are being made with tubing lengths of 9, 18, 36 and 60 in., the tubing being made with braided shielding, flexible steel armor or neoprene insulation. Woven braided metallic shielding is recommended for general purpose work,



Flashlights with steel-armored and neoprene-insulated flexible extensions

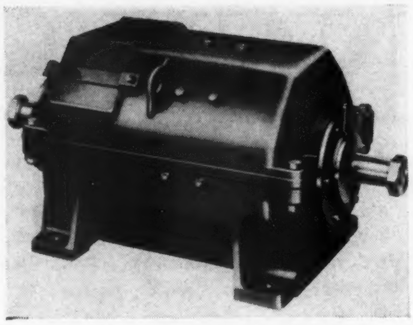
where the light is used in the inspection and repair of light machinery. Flexible steel armor is extremely rugged and will stand indefinite abrasion in heavy-duty service, as in working with boiler tubes and deep cylinders. The neoprene-insulated type is for use around electrical equipment.

The new flexible extensions are available on both the Junior DeLuxe Model 55 Flex-Lite, which uses two penlite batteries, and the Master Model 75 powered by two D-type large cells. Cases are oversize to permit batteries to swell. A stainless steel switch utilizes a coil spring to slide batteries into positive contact with the bulb extension.

The Flex-Lite flashlights are made by the Aero-Motive Manufacturing Company, 1803 Alcott street, Kalamazoo 24, Mich.

Heavy Duty Direct Current Motor

The Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., announces the addition of a 600 series mill motor to its line of d.c. steel mill motors. The motor is adaptable for use totally-enclosed non-ventilated or separately ventilated. It can also be furnished for self-ventilation. The self-ventilated machines are cooled by a fan mounted at the rear of the armature; in the totally-



Crocker-Wheeler 600 Series mill motor

enclosed non-ventilated motors, the fan action is provided by the back ends of the coil supports. Internal circulation of air lowers hot spot temperatures.

Shortened bearing housings, careful proportioning of field pole design, and the use of other developments in design and materials convert inactive space and weight into greater driving power.

Special grease slingers and grooves keep grease and dust away from commutator and windings. The bearing caps are readily removable to facilitate bearing inspections. The improved solid cylindrical roller bearings are completely supported against thrust and radial loads. Shaft stress is low because the bearings are close to the load.

Improved commutation is provided by split brushes and four interpoles. Ready access to the commutator bolts is provided in all motors. The coils have extra support against vibration.

Steam Generator For Diesel Locomotives

The Vapor Heating Corporation, Chicago, recently demonstrated a new steam generator for Diesel locomotives designed to give increased capacity, reliability and flexibility in supplying the large amounts of steam required for operating long passenger trains under extreme temperature conditions.

The new generator, known as the Vapor Intensi-Fired OK No. 4625, is constructed with patented, staggered-coil assemblies used in previous Vapor generators. New features include an offset blower which gives the air for combustion a circular motion in passing through the coils and a further simplification of OK controls which are largely assembled in a simple front panel.

An output of 2,500 lb. of steam per hour is developed at 81.2 per cent efficiency in the new generator which occupies practically the same amount of floor space as the 1,600-lb. unit formerly built.

Drafting Equipment

Two products have been designed by the Emmert Manufacturing Company, Waynesboro, Pa., to increase the accuracy of and reduce the time required for drafting. The first of these products is a stainless-steel drafting machine which will operate on any size or make drawing board without the addition of extra equipment or the alteration of the drawing board. Because the machine operates in any position from true horizontal to true vertical, a comfortable working position may be continuously maintained, resulting in greatly decreased fatigue of draftsmen and consequent improvement in the quality and quantity of their work.

Angles are indexed through a micromatic quadrant, which allows indexing of every three degrees by flipping the quadrant minute-adjusting screw into the desired degree setting. Adjustments as fine as 2½ minutes may be made by a slight turn of the minute-adjusting screw. These machines are manufactured for boards of any length and from 24 in. to 132 in. high in twelve steps. Special machines, including left-handed machines, can be furnished for odd-size drawing boards.

Vertical counterbalanced full-size drafting board units for full size work up to eleven feet high by any length as well as draftsman's desk units, and horizontal-vertical counterbalanced adjustable board units are also available.

Emmert drafting equipment

NEWS

B.C.R. Authorizes Budget of One-Half Million Dollars

To create new markets and to hold and expand present markets, the Board of Directors of Bituminous Coal Research, Inc., the national research agency of the bituminous coal industry, has authorized a research budget of more than half a million dollars for the second consecutive year. This will finance the development of new equipment, methods for more efficient coal utilization, and fundamental research.

The program outlined by B.C.R. executives at the board's recent annual budget meeting in Pittsburgh, Pa.; authorizes the expenditure of $515,800 to continue the industry-sponsored general research program for 1949. This budget is exclusive of the programs being conducted by the B.C.R. Mining Development and Locomotive Development Committees and does not include substantial sums made available by co-sponsors on certain projects of the general research program.

The work proposed for the coming year is for the most part a continuation of the 1948 program. Attention will be given to further development and commercial introduction of residential heating equipment, new methods of industrial coal utilization, and improved performance of steam locomotives. Several new projects will be undertaken in 1949, including work on cinder collectors for small plants and locomotive fuel studies. B.C.R. in co-operation with Battelle Memorial Institute and others, will initiate a program on improved gas producers, and co-operative research will be conducted with other solid fuel associations and groups of manufacturers on projects of mutual importance.

The funds for B.C.R. research are provided by 340 coal companies, railroads, and manufacturers.

A.S.M.E. Cites C. G. Curtis for Pioneering Gas Turbines

Charles G. Curtis, president of the International Curtis Marine Turbine Company, was honored on November 30 by the American Society of Mechanical Engineers at its 69th annual meeting in New York. At a dinner in the Hotel Pennsylvania sponsored by the gas turbine power division of the society, Mr. Curtis received the first annual award of that division, an engrossed certificate, which cited him "for his pioneer work in the field of gas turbines, which resulted in his being granted, in 1899, the first American patent covering a complete gas-turbine power plant."

The award was presented to Mr. Curtis by John T. Rettaliata, dean of engineering at the Illinois Institute of Technology and chairman of the A.S. M.E.'s gas turbine power division. The division was organized just over a year ago with R. Tom Sawyer of the American Locomotive Company as its first chairman.

A.S.M.E. Railroad Division Installs New Officers

In conjunction with the annual meeting of the American Society of Mechanical Engineers, held at New York November 28 to December 3, the Railroad Division conducted two all-day technical sessions, at the close of which the following members of the executive committee were installed for 1949: B. S. Cain, assistant engineer, locomotive division, General Electric Company, Erie, Pa., chairman; J. M. Nicholson, director of research, Atchison, Topeka & Santa Fe, Chicago; E. D. Campbell, consultant, American Car & Foundry Co., New York; K. A. Browne, research consultant, Chesapeake & Ohio, Cleveland, Ohio; C. H. Beck, vice-president, Westinghouse Air Brake Company, Wilmerding, Pa., and E. L. Woodward, western editor, *Railway Mechanical Engineer*, Chicago, secretary. Three incoming new members of the general committee included E. R. Battley, chief of motive power and car equipment, Canadian National, Montreal, Que.; J. D. Loftis, chief of motive power and equipment, Atlantic Coast Line, Wilmington, N.C., and E. M.

Orders and Inquiries for New Equipment Placed Since the Closing of the December Issue

Locomotive Orders

Road	*No. of locos.*	*Type of loco.*	*Builder*
Detroit Terminal	2[1]	1,000-hp. Diesel-elec. switch	Electro-Motive
Erie	4[2]	660-hp. Diesel-elec. switch	American Loco.
	4[2]	1,000-hp. Diesel-elec. switch	American Loco.
	4[2]	750-hp. Diesel-elec. switch	Baldwin Loco.
	2[2]	1,000-hp. Diesel-elec. switch	Baldwin Loco.
	6[2]	1,000-hp. Diesel-elec. switch	Electro-Motive
	6[2]	1,000-hp. Diesel-elec. switch	Lima-Hamilton
Kentucky & Indiana Terminal	5[3]	1,000-hp. Diesel-elec. switch	Fairbanks-Morse

Freight-Car Orders

Road	*No. of cars*	*Type of car*	*Builder*
Ann Arbor	60[4]	70-ton covered hopper	Pullman-Standard
Atchison, Topeka & Santa Fe	50	Gondola	Co. shops
	250	70-ton covered hopper	Co. shops
Chicago, Milwaukee, St. Paul & Pacific	2,330	Gondola	Co. shops
	1,000	Box	Co. shops
	500	Flat	Co. shops
	50	Caboose	Co. shops
Chicago, Rock Island & Pacific	100	70-ton covered hopper	Pullman-Standard
	1,000	70-ton gondola	Co. shops
Denver & Rio Grande Western	25[5]	70-ton covered hopper	Pullman-Standard
	500[5]	50-ton gondola	Pressed Steel Car
	200[5]	70-ton gondola	Pullman-Standard
Escanaba & Lake Superior	5[6]	50-ton gondola	Pullman-Standard
	5[6]	70-ton hopper	Pullman-Standard
Great Northern	500	50-ton gondola	Pullman-Standard
	100	70-ton covered hopper	Pullman-Standard
Merchants Despatch Transportation Co.	60	55-ton refrigerator	Co. shops
Minneapolis, St. Paul & Sault Ste. Marie	35[7]	70-ton hopper	General American
Missouri-Kansas-Texas	25	50-ton gondola	Co. shops
Northern Pacific[8]	250	Caboose	Co. shops
	200	75-ton ore	Co. shops
	250	40-ton refrigerator	Pacific Car & Fdry.
Spokane, Portland & Seattle	100[7]	50-ton gondola	Pullman-Standard
Western Pacific	250	70-ton gondola	Greenville Steel Car

Passenger-Car Orders

Road	*No. of cars*	*Type of car*	*Builder*
Bangor & Aroostook	3[9]	Coaches	Pullman-Standard
Minneapolis, St. Paul & Sault Ste. Marie	2[10]	Baggage	American Car & Fdry.

[1] For delivery during May.

[2] Delivery of these locomotives is expected to begin in the first quarter of 1949 and be completed in the second quarter of 1950.

[3] For spring delivery.

[4] Delivery expected in March.

[5] For delivery in March.

[6] For delivery in April.

[7] For delivery in second quarter of this year.

[8] The board of directors of the Northern Pacific have also authorized the purchase of 250 50-ton hopper cars.

[9] The cars, each of which will accommodate 80 passengers, will have Sleepy Hollow seats, wide vision windows and fluorescent lights. Each car will have a smoking compartment with individual lounge chairs separated from the rest of the car by a plate-glass partition. Delivery is expected in June, when the cars will be placed in service on the "Aroostook Flyer" between Bangor, Me., and Van Buren.

[10] For delivery in the fourth quarter of this year.

Notes: *Chicago, Rock Island & Pacific.*—The Rock Island will convert 200 of its box cars into stock cars at the rate of approximately 75 a month. The work, which will be done at the road's own shops, will begin as soon as material becomes available. *Northern Pacific.*—The Northern Pacific has been authorized by its board of directors to purchase four 4,500-hp. Diesel-electric locomotives for passenger service at an estimated cost of $2,250,000.

Southern Pacific—Seventy-two of the 78 passenger cars ordered from the Budd Company, as reported in August, 1948, issue, will be equipped with the Budd disk brake. The remaining six baggage-postal cars will also be equipped with the disk brake if the application of the disk brake to a six-wheel truck can be carried out in time.

Union Pacific—Disk brakes will be applied to the fifty stainless-steel sleepers being built by the Budd Company, the order for which was announced in the April, 1948, issue.

Van Winkle, vice-president, American Steel Foundries, New York.

During the Division luncheon on December 2, the following members were elevated to the grade of Fellow in the Society: Karl Howard, vice-president, General Steel Castings Corporation, Eddystone, Pa.; E. S. Pearce, president, Railway Service & Supply Corp., Indianapolis, Ind.; Ellis W. Test, assistant to president, Pullman-Standard Car Manufacturing Company, Chicago; C. K. Steins, mechanical engineer, Pennsylvania, Philadelphia, Pa.; A. A. Raymond, superintendent fuel and locomotive performance, New York Central, Buffalo, N.Y., and Leigh Budwell, chief mechanical officer, Richmond, Fredericksburg & Potomac, Richmond, Va.

Approximately 300 railroad and railroad supply men attended the several sessions of the division, where a number of technical papers dealing with motive power and car equipment design and maintenance were presented.

Underwriters Approve Aluminum Air Ducts

The National Board of Fire Underwriters has approved aluminum for use in the installation of ducts for air conditioning, warm-air heating, air cooling, and ventilating systems. The approval has been granted on the recommendation from the Committee on Air Conditioning of The National Fire Prevention Association. The committee's recommendation is based on a careful study of aluminum's satisfactory performance in a large number of duct applications.

The 1948 edition of N.B.F.U. Pamphlet Number 90 will be issued soon and will contain the revision to include standards for ducts constructed of aluminum. The standards will cover installation for residences as well as for industrial buildings. Copies of the standards may be obtained from the National Board of Fire Underwriters Offices at 85 John street, New York 7; 222 West Adams street, Chicago 6, or Merchants Exchange Building, San Francisco 4, Calif. They may also be secured through local fire inspection bureaus which work closely with the N.B.F.U.

The new changes include a section which points out that aluminum, cadmium-plated or zinc-coated hardware and fittings, such as nuts, bolts, clamps, sheet metal screw and rivets, should be used in the fabrication and erection of aluminum duct work.

Diesel Engine Manufacturers Elect Officers for 1949

Robert H. Morse, Jr., vice-president in charge of all operation of Fairbanks, Morse & Co., was elected president and treasurer of the Diesel Engine Manufacturers Association at the Association's annual meeting held in Chicago, December 8. Elected as vice-presidents were A. W. McKinney, executive vice-president, National Supply Company, and O. H. Fischer, president, Union Diesel Engine Company. Directors elected were George W. Codrington, vice-president, General Motors Corporation and general manager, Cleveland Diesel Engine Division; Perry T. Egbert, vice-president in charge of Diesel and locomotive sales, American Locomotive Company; Robert E. Friend, president, Nordberg Manufacturing Company; Gordon Lefebvre, president, Cooper-Bessemer Corporation; Walter A. Rentschler, vice-president, Lima-Hamilton Corporation; E. J. Schwanhausser, vice-president in charge of sales, Worthington Pump & Machinery Corporation; Marvin W. Smith, executive vice-president, Baldwin Locomotive Works; Mr. Morse, Mr. McKinney, and Mr. Fischer.

A.C.L. Shops Visited by Engineers

On November 12 the Raleigh, N. C., section of the American Society of Mechanical Engineers held a meeting at Rocky Mount, N. C., during which the Atlantic Cost Line was host for an afternoon tour of its Emerson shops and storehouse.

In addition to the Raleigh section, members of the Piedmont and Virginia sections of the A.S.M.E. of the Burlington-Graham Engineering Club, the East Carolina Engineers' Club, and the Virginia Engineering Society were invited. Engineering students from Duke University and North Carolina State College were also included.

Following the inspection tour, the group met for dinner at the Ricks Hotel, after which there was a program arranged by J. D. Loftis, chief of motive power and equipment, A. C. L., and program chairman of the section. In brief addresses 11 officers of the railroad set forth the functions of its various departments. They were J. M. Fields, assistant vice-president (freight traffic department); J. H. Hatcher, assistant passenger traffic manager; L. T. Andrews, general superintendent transportation; G. L. Mitchell, general purchasing agent; R. L. Groover, chief engineer; J. S. Webb, chief engineer communications and signals; W. D. Quarles, assistant chief of motive power; H. G. Moore, assistant chief of equipment; H. J. Stein, mechanical engineer; R. W. Tonning, electrical engineer, and B. K. Conrad, engineer of tests.

The need and the opportunities in railway service for young engineers who possess "native common sense" as well as a good technical education were stressed by several of the speakers representing technical departments.

Among the guests were L. Y. Ballantine, lieutenant governor of North Carolina; W. M. Sheehan, vice-president, General Steel Castings Corporation, and director-at-large of the A.S.M.E.; Millard Jones, director, L. S. Jeffords, vice-president and general manager, and Pomeroy Nichols, treasurer, of the Coast Line.

D. T. & I. Diesel Shop at Flat Rock, Mich.

Detroit industrial executives were guests recently of the Detroit, Toledo & Ironton for an inspection of the road's new Diesel repair shops at Flat Rock, Mich., and of the latest types of freight cars on display there. The Diesel shop, located adjacent to the Flat Rock engine-

* * *

New 142-ft. by 407-ft. C. & N. W. Diesel shop in Chicago which was officially opened December 16. It is equipped to service nine Diesel locomotive units simultaneously while at the same time handling three additional units undergoing heavy repairs. The central bay is serviced by a 30-ton traveling crane with a 75-ft. span, and a drop table serves all tracks. Repair rooms for reconditioning various parts are supplied with filtered air. Outside the shop, concrete ramps between tracks are equipped with radiant heating to melt the snow and ice

house, at which the road's steam locomotives are serviced, was built at a cost of $500,000 to handle seven new General Motors 1,000-hp. switching locomotives and two 600-hp. switchers already owned.

The Diesel shop has been equipped with the latest-type machinery and facilities, including an exhaust system for removing the gases from idling Diesel engines without loss of the heated inside air of the shop. The removal system comprises four adjustable overhead ducts which fit over the exhaust pipes of locomotives on two adjacent repair tracks and which are constructed and mounted in a manner that avoids interference with the overhead 25-ton traveling crane. The four ducts lead to a central collecting point and suction fan on the roof which dissipates the exhaust fumes to the atmosphere.

Wilson Receives Crozier Medal

CHARLES E. WILSON, president of the General Electric Company, received the American Ordnance Association's Crozier gold medal for distinguished ordnance service at the industrial preparedness meeting at the Waldorf-Astoria hotel, New York, on December 6. The medal was awarded to Mr. Wilson in recognition of his services as vice-chairman of the War Production Board during World War II and his leadership in fields of science and industry related to national defense.

Kerosene as a Thinner in Journal Boxes

Due to error in stating the minimum flash point and fire point for oils used for cut-back or thinning purposes in journal boxes during winter months, a circular letter issued by the A.A.R. Mechanical Division under the above subject dated October 22, 1948 has been cancelled and the following letter substituted:

"Attention has been directed by member roads to the use of kerosene as a cutback in journal boxes during winter weather, on account of the oil becoming congealed.

"Kerosene should not be used in journal boxes under any circumstances as it lowers the flash point of the car oil and reduces its lubricating value. Any oil having a flash point lower than 300 deg. F. should not be used for cut-back or thinning purposes.

"The Committee on Lubrication of Cars and Locomotives call attention to the fact that hot car oil is the best thinner to use in journal boxes."

In an editorial reference to this letter in the December *Railway Mechanical Engineer*, a 350-deg. minimum flash point was incorrectly given.

Study Shows Relationship of Car Lengths and Capacities

THE Car Service Division of the Association of American Railroads has prepared for distribution to transportation department officers of the railroads a statement showing how the freight-car ownership of the country divides as to lengths of cars of different types and nominal capacities. The data, based on the Railway Equipment Register, indicate the relationships within the various categories on a percentage basis, and also the number of cars of various lengths and capacities separately for the Eastern, Southern and Western districts and the Pocahontas region.

Supply Trade Notes

OAKITE PRODUCTS, INC.—*Donald R. Royal* and *Paul E. Ward* have been appointed representatives of the railway service division of Oakite Products, Inc., in Atlanta, Ga., and Chicago, respectively. *Frank L. Oldroyd* has been appointed sales manager of the Industrial Division of Oakite.

Mr. Royal was formerly with the Illinois Central for 18 years. He began his career as an apprentice at Birmingham, Ala., and was general foreman of the locomotive department at Centralia, Ill., until his appointment as a repre-

D. R. Royal

sentative of Oakite. Mr. Royal's record includes experience in locomotive and car department operations, as well as service in connection with Diesel, steam locomotive and car maintenance and shopping procedures. As a representative of Oakite, he will operate out of Atlanta, serving roads in the southeastern area.

Mr. Ward was for a period of eight years in the locomotive department of the Chicago, Burlington & Quincy. He

P. E. Ward

left the C.B. & Q. to represent the Locomotive Finish Materials Company, Atchison, Kan. As a representative of Oakite, Mr. Ward will serve the railroads in the Midwest area.

Mr. Oldroyd has been associated with the Oakite organization in the servicing of its specialized industrial cleaning and allied materials for over fifteen years, having spent eleven of these years as an Oakite field service territorial representative in various sections of the country. Subsequent promotions found him acting in the capacity of division manager in the company's divisional offices in Atlanta and Chicago for a period of two and one-half years, then as special field sales manager for a year prior to his most recent appointment. Mr. Oldroyd will direct the activities of Oakite's nationwide industrial field staff from the company's general offices in New York.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*Rudolf R. Kopfmann*,

R. R. Kopfmann

formerly manager of research and promotion of Associated Business Papers, has joined the eastern advertising sales

staff of the Simmons-Boardman Publishing Corporation. In his new capacity, Mr. Kopfmann will represent all Simmons-Boardman transportation periodicals—*Railway Age, Railway Mechanical Engineer, Railway Engineering and Maintenance, Railway Signaling,* and *Marine Engineering* and *Shipping Review.* He will also continue in an advisory capacity his previous work with the Associated Business Papers promotion committee.

Mr. Kopfmann was born at New York on August 31, 1917. He studied advertising and selling at Pace Institute and New York University, and began his business career with the Public National Bank & Trust Co. of New York. In 1937, after brief periods with the Acme Fast Freight Company, and in the correspondence and sales departments of Brooks Bros., Inc., he joined the staff of Associated Business Papers as assistant to the advertising manager. In 1944 he was advanced to manager of research and promotion.

◆

WHEEL TRUING BRAKE SHOE COMPANY.—*Gordon H. Proffitt* has been appointed western representative for the Wheel Truing Brake Shoe Company, Detroit, Mich., with headquarters in the Matson building, San Francisco, Calif. The company formerly was represented by R. W. Jamison on the west coast.

Mr. Proffitt, who is a graduate of the University of California, spent several

G. H. Proffitt

years with the Standard Oil Company in an engineering capacity and later with the federal government in engineering and administrative work. Since 1940 he has been a manufacturers' representative, handling material and equipment for railroad, marine, bus and industrial use. *J. P. Williams, Jr.,* who has been engaged in the transportation field for the past 15 years, is associated with Mr. Proffitt.

◆

WATSON-STILLMAN COMPANY.—*J. T. Gillespie, Jr.,* director of export sales of the *Watson-Stillman Company,* has been appointed general sales manager, in which position he will continue to supervise the company's export sales. *Richard*

NEW STEAM LOCOMOTIVES

now entering service on...

LIMA-HAMILTON is currently delivering 15 additional 2-6-6-6 locomotives to the Chesapeake and Ohio.

These locomotives are Class H-8. On dynamometer tests, this class . . .

- ***Developed a drawbar pull of 117,500 lbs.***
- ***Developed an instantaneous drawbar horsepower of 7498 at 46 mph, and sustained drawbar horsepowers of 6700 to 6900 at speeds of 42 and 46 mph.***
- ***Accelerated 160 loaded cars (14,083 tons) from dead stop to 19 mph in one mile, and reached 29 mph in 11 minutes.***

These 15 make up our fifth order from the Chesapeake & Ohio for Class H-8 locomotives — for a total of 60. This is proof in itself of the capable job that they are doing.

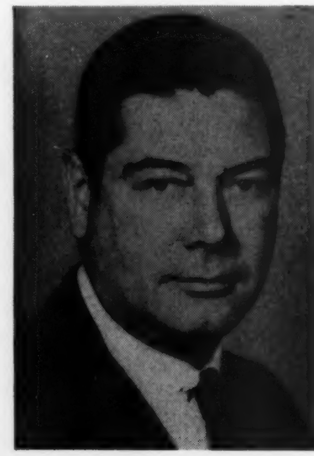
LIMA HAMILTON CORPORATION

DIVISIONS: *Lima, Ohio*—Lima Locomotive Works Division; Lima Shovel and Crane Division. *Hamilton, Ohio*—Hooven, Owens, Rentschler Co.; Niles Tool Works Co. *Middletown, Ohio* — The United Welding Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.

W. Schreck has been appointed Michigan divisional sales representative for the company.

Mr. Gillespie, before joining Watson-Stillman, held sales and administrative positions with the Air Reduction Company, New York, and with its subsidiary,



J. T. Gillespie

Wilson Welder & Metals Co., where he was assistant to the president.

Mr. Schreck became associated with Wason-Stillman in May, 1948. Prior to that date he was associated with the Hydraulic Press Manufacturing Com-

R. W. Schreck

pany as sales engineer. In addition to his present duties in Michigan, he will act as special consultant on hydraulic machinery for two Watson-Stillman representatives—the Frank T. Goetz Machinery Company, Cleveland, Ohio, and the W. K. Millholland Machinery Company, Indianapolis, Ind.

◆

Gould Storage Battery Company.—A series of practical "schools" to teach better techniques of storage battery maintenance and repair to foremen, supervisors and engineers in industries using lead-acid batteries for motive power, or standby or direct current supply, has been inaugurated at Trenton, N. J., by the Gould Storage Battery Corporation. Future five-day schools will be conducted, according to M. W. Heinritz, Gould vice-president, for classes interested in (1) battery-powered lift trucks

and materials, handling systems; (2) telephone and other communications systems; (3) railway car lighting, Diesel starting and air conditioning, and (4) transportation signal work. The next school to be held will probably be organized specifically to help industrial truck users.

◆

Baldwin Locomotive Works.—*Curtis G. Green*, whose appointment as manager of the Chicago district office of the Baldwin Locomotive Works was reported in the October, 1948, issue, was

born in St. James Parish, La. He has been associated with Baldwin since 1920 in various sales and engineering capacities which took him into all parts of the country. For two years immediately prior to his recent appointment Mr. Green was manager of Mexican sales.

◆

American Brake Shoe Company.—*N. George Belury* has been appointed president of the Engineered Castings Division of the American Brake Shoe Company.

Mr. Belury has been with American Brake Shoe since graduating from Purdue University in 1937. He was formerly division vice-president, and had also served in various sales capacities with Engineered Castings including that of sales manager. He is a member of the Gray Iron Founders Association and the American Society of Mechanical Engineers. Mr. Belury will continue to be located at the Division's headquarters in Rochester, N. Y.

◆

Hammond Machinery Builders, Inc.—*The Hammond Machinery Builders, Inc.*, Kalamazoo, Mich., has opened a new office at 1021 East Eighth street, Los Angeles 21, Calif., to serve the West Coast metal finishing industry. *E. C. Hammett* has been appointed western representative at the office.

◆

Vapor Heating Corporation.—Forty-seven employees, with 25 years or more service totaling 1,457 years, were honored at a dinner on November 11 when A. D. Bruce, president of the *Vapor Heating Corporation*, presented

each with an engraved watch in appreciation of loyal service. Mr. Bruce has been associated with the corporation for 39 years.

◆

Mines Equipment Company.—*The Equipment Research Corporation,* 64 East Jackson boulevard, Chicago, of which *J. A. Amos* was recently elected president, has been appointed exclusive railroad sales agents for the products of the Mines Equipment Company of St. Louis, Mo.

◆

Whiting Corporation.—*G. E. Seavoy* has been appointed vice-president in charge of the Process Sales Division, and *M. J. Rice,* vice-president in charge of the Industrial Sales Division of the Whiting Corporation, Harvey, Ill. Mr. Seavoy will direct all field sales operations, including advertising, field erection, and service. Mr. Rice will direct all of the company's product sales divisions.

◆

Joseph T. Ryerson & Son.—*Frank W. Eichman* has been appointed sales manager of the Philadelphia, Pa., plant and *C. H. Hallett* as manager of sales of the Los Angeles, Calif., plant of *Joseph T. Ryerson & Son.*

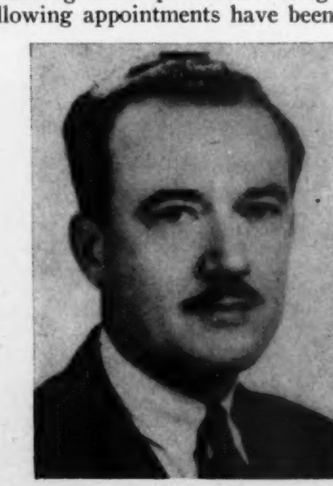
Mr. Eichman, who has spent his entire business career with Ryerson, joined the company in 1922 at the New York plant. He was appointed sales representative in the New York area in 1932 and was transferred to the Philadelphia plant as sales representative in 1938.

Mr. Hallett joined Ryerson in 1941, serving first in the Buffalo, N. Y., plant and later as assistant to the sales manager at Chicago. He was transferred to Los Angeles in 1948.

◆

Sherwin-Williams Company.—The Atlantic coast transportation zone office of the Sherwin-Williams Company has been moved from Brown and Lister streets, Newark, N.J., to 92 Liberty street, New York.

Among other personnel changes, the following appointments have been made



R. H. Hill

in the transportation sales division of the Sherwin-Williams Company: *R. H. Hill,* manager of the Atlantic Coast zone, with

YEARS MAKE LITTLE DIFFERENCE TO GM DIESELS

FROM RAILWAY AGE, OCTOBER 12, 1946

3,594,222 Freight Miles over mountains and desert

6,020,203

AVAILABILITY 89.6%

88.9%

THE Western Pacific, with main line from Oakland, California to Salt Lake City, Utah, is a good solid test of a freight locomotive's stamina and dependability.

The terrain ranges from rugged mountainous hauls in the Sierra Nevadas, including Feather River Canyon, to considerable stretches of desert run. Since the line is a vital link for hauling much perishable freight, fast schedules must be kept.

Here's what 12 General Motors Freight Diesels show on the Western Pacific. Together these locomotives — while amassing 3,594,222 miles — have an average availability of 89.6%. The average mileage per locomotive per month is 7,361 miles.

9053

Such *actual* records, in all kinds of service, distinguish General Motors Diesels. Such *actual* records point up the extra value inherent in these locomotives, designed and built by specialists in Diesel locomotives.

6,020,203

88.9%

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILL.

Up-to-date figures are all that are needed to give you the latest report of General Motors Diesel freight locomotives on the Western Pacific.

In their seventh year of operation, these 12 General Motors Diesels have rolled up a total of 6,020,203 miles, with availability* close to 90% throughout the period.

As shown by the performance table below, average monthly mileage per locomotive increased from 7,523 the first year to 9,661 in 1947 — and they're still keeping up the same fast clip.

About the only difference years make to General Motors locomotives is that they are very apt to improve with age. Being built to standardized specifications — with constant engineering development — replacements can often be made with an improved part that does the job even more efficiently than the original.

Worth considering, isn't it?

PERFORMANCE RECORD OF GENERAL MOTORS DIESELS ON WESTERN PACIFIC

No. Locos.	Period	Total Miles Operated	Average Miles Operated Per Loco. Per Month	Per Cent Availability* (All Locos)
3	12-8-41 through 12-31-42	278,317	7,523	83.1
6	1943	418,949	8,215	90.8
12	1944	824,801	8,416	89.7
12	1945	1,336,131	9,279	91.0
12	1946	1,308,339	9,086	90.5
12	1947	1,391,171	9,661	88.3
12	1-1-48 through 4-30-48	462,495	9,635	86.3
TOTAL		6,020,203	9,053 (Av.)	88.9 (Av.)

***Availability based on hours available for service to total potential hours.**

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS • LA GRANGE, ILL.

Home of the Diesel Locomotive

headquarters in New York; *J. F. Senters* and *W. H. Riemann*, sales representatives under Mr. Hill, at New York; *J. R. Stevenson*, in charge of the Gulf states zone, at Dallas, Tex.; *W. J. Boll*, sales representative at Pittsburgh, Pa., and *J. W. Wernicke*, Western area sales representative, with headquarters at Chicago.

Mr. Hill has been associated with Sherwin-Williams for 31 years and has held many sales and executive positions, including assistant to trade sales manager, metropolitan division trade sales manager, pleasure craft sales manager, and transportation territorial representative.

Mr. Stevenson has been with Sherwin-Williams since 1916. In addition to handling transportation sales he also will be in charge of industrial sales in the Gulf states area.

J. R. Stevenson

Mr. Wernicke joined the sales department of the company, at Chicago, in February, 1931. For five years he was associated with trade sales; for four years with industrial sales, and for the last eight years with transportation sales.

J. W. Wernicke

◆

Electric Service Manufacturing Company.—*Russell Kreinberg* has been elected president of the Electric Service Manufacturing Company. *Ira W. Schmidt* has been elected vice-president

and sales director; *E. A. Leinroth*, vice president and treasurer; *H. J. Graham*, vice-president in charge of manufacturing; *J. R. McFarlin*, vice-president and secretary; and *D. B. Reeves*, assistant treasurer.

◆

Wyandotte Chemicals Corporation, J. B. Ford Division.—Thirteen sales representatives of the J. B. Ford Division of Wyandotte Chemicals Corporation recently received gold watches commemorating 25 years of service to the company. This brings to 1,342 the total number of Wyandotte Chemicals employees who have merited quarter century honors.

◆

General Electric Company.—*William F. Schryver* has been appointed superintendent of the locomotive manufacturing division of the *General Electric Company*.

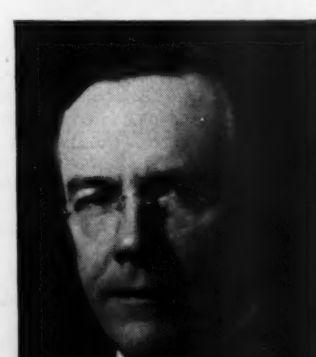
Mr. Schryver joined the company in 1916 as a tool maker. He was appointed foreman in charge of building maintenance for the refrigerator cabinet division in 1931; general foreman in charge of assembly in the gun mount division in 1940; acting superintendent of the machine section of that division a year later, and superintendent in 1943. Mr. Schryver was transferred to the locomotive and car equipment control division in 1945 as assistant superintendent. He became superintendent in 1946.

◆

Buda Company.—The Chicago railroad sales office of the *Buda Company*, formerly located at 35 East Wacker Drive, was moved recently to Harvey, Ill.

◆

National Lead Company.—*William V. Burley* has been appointed general manager of the Magnus metal division of the National Lead Company. Mr. Burley, who succeeds *W. H. Croft*, retired, will supervise and direct all phases of the Magnus manufacturing, administrative and selling activities.



W. V. Burley

Mr. Burley joined National Lead as a member of the comptroller's staff in

1922 and, in 1925, was placed in charge of the Mueller Brass Foundry Company, St. Louis, Mo., with the title of secretary and treasurer. In March, 1936, he became comptroller of the Magnus Metal Company and, in April, 1938, assistant general manager of the Magnus Metal division, continuing as comptroller. He was appointed manager of the St. Louis branch in 1939 and became a director of National Lead in the following year. On May 25, 1943, he was elected a vice-president and in July, 1948, became a member of the executive committee.

◆

REYNOLDS METALS COMPANY.—*The American Brass & Copper Co.,* Oakland, Calif., and the *Western Metals & Supply Co.,* San Diego, Calif., have been appointed distributors of Reynolds aluminum products.

◆

KERITE COMPANY.—*Arthur H. Smith,* railroad sales manager of the *Kerite Company* since November, 1945, has been elected a vice-president.

Mr. Smith began his career in 1912 with the Railroad Supply Company and was assistant vice-president when he left in 1932 to become vice-president of the Railroad Materials Corporation. He later was associated with the Youngstown Sheet & Tube Co., where he was in charge of sales to eastern railroads. Mr. Smith joined Kerite in 1934.

Arthur H. Smith

◆

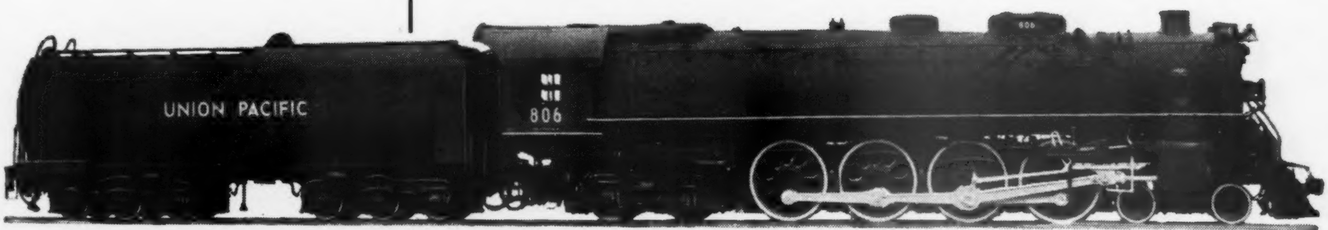
AMERICAN CAR & FOUNDRY CO.—*Nelson C. Walker* has been appointed assistant district manager of the plant of the American Car & Foundry Co., at Berwick, Pa.

◆

BOWSER, INC.—*Fred S. Ehrman,* general sales manager of Bowser, Inc., Fort Wayne, Ind., has been elected to the newly created post of vice-president and director of sales. Fred S. Ehrman, general sales manager since 1944, has been elected to the newly created post of vice-president and director of sales.

Mr. Ehrman joined the company in 1925 and has served successively in experimental engineering, sales engineering and divisional sales work.

A LOCOMOTIVE
that started a trend



UNION PACIFIC

uses Compensators and Snubbers on 146 roller-bearing locomotives to cut maintenance costs.

Fifty-nine roads use Compensators and Snubbers to reduce maintenance costs. These twenty roads use them on Roller Bearing Locomotives:

- A. T. & S. F.
- C. & N. W.
- C. M. St. P. and P.
- Clinchfield
- Delaware & Hudson
- D. M. & I. R.
- D. L. & W.
- Great Northern
- Missouri Pacific
- Northern Pacific
- N. C. & St. L.
- New York Central
- Norfolk & Western
- Southern Pacific
- S. P. & S.
- Texas & Pacific
- Union Pacific
- Western Maryland
- Railways of France
- National Railways of Mexico

The Franklin Automatic Compensator and Snubber established its maintenance reduction records on locomotives equipped with surface bearing driving boxes. It was Union Pacific ten years ago with its 800 class locomotives that conclusively proved that this device is equally important with roller bearings.

Since 1937 Union Pacific has equipped forty-five 4-8-4, seventy-six 4-6-6-4 and twenty-five 4-8-8-4 type locomotives with the Compensators and Snubbers and Roller Bearings. The performance record is conclusive in the reduction of maintenance and reliability of service.

Experience of 59 railroads on locomotives of widely varying types and under all varieties of operating conditions shows definitely that maintenance costs are reduced by the Compensator and Snubber because it eliminates the clearance between the driving box, or housing, and the frame, regardless of expansion or wear. Pounds are reduced, minimizing wear and failure of crank pins and rod bearings. Close fitting roller bearing assemblies are protected by the snubber because it cushions abnormal shocks. This device saves time — hours of it — since it seldom needs adjustment but which, when needed is easily made.

REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

Obituary

F. W. Dressel, former vice-president of the Lovell-Dressel Company, died on December 1. He was 82 years old.

Personal Mention

General

Don McIntyre has been appointed general supervisor of air brakes and lubrication of the Missouri Pacific, with headquarters at St. Louis, Mo.

G. T. Callender, mechanical superintendent, Western district, of the Missouri Pacific at St. Louis, Mo., has been granted a sick leave.

W. R. Sugg, general supervisor of air brakes and lubrication of the Missouri Pacific at St. Louis, Mo., has been appointed acting mechanical superintendent, Western district, with headquarters remaining at St. Louis.

David C. Reid, general superintendent of motive power of the Boston & Maine and the Maine Central, with headquarters at Boston, Mass., has been appointed mechanical assistant of those roads, reporting to the general manager. The position of general superintendent of motive power has been abolished.

P. C. Wingo, assistant superintendent of the Pocahontas division of the Norfolk & Western at Bluefield, W. Va., has been appointed superintendent of the Shenondoah division, with headquarters at Roanoke, Va. Mr. Wingo joined the

P. C. Wingo

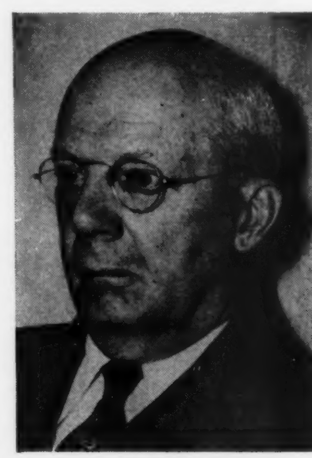
N. & W. on July 31, 1922, as a machinist at the Roanoke shops. He was furloughed to attend school and returned as a shop inspector in December, 1924. After serving in several capacities in the Roanoke shops Mr. Wingo, in September, 1935, became draftsman in the motive power office. He was appointed shop engineer at Roanoke in 1937; assistant road foreman of engines at Bluefield, W. Va., in 1938; assistant trainmaster on the Pocahontas division in

October, 1941; trainmaster of the Radford division in September, 1943, and assistant superintendent of the Pocahontas division at Bluefield in February, 1948.

D. R. RODGERS, assistant to chief mechanical officer of the Missouri Pacific at St. Louis, Mo., has retired.

PAUL C. DUNN, assistant general superintendent of motive power of the Boston & Maine and Maine Central at Boston, Mass., has been appointed superintendent of locomotive maintenance. The position of assistant general superintendent of motive power has been abolished.

A. R. AYERS, general manager of the New York, Chicago & St. Louis at Cleveland, Ohio, has retired. Mr. Ayers, who was born at Toledo, Ohio, on October 26, 1878, and is a graduate of Cornell University with a degree in mechanical engineering. He entered railroad service in 1900 as special engineer for the Lake Shore & Michigan Southern (now New York Central) and in 16 years became engineer of rolling stock and principal assistant engineer of the New York Central at New York. Mr. Ayers was appointed superintendent of motive power of the Nickel Plate at Cleveland on October 1, 1916; assistant general manager on February 2, 1923, and general manager on November 10, 1927.



A. R. Ayers

FRANK W. BUNCE, whose promotion to mechanical superintendent—steam power, of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., was reported in the November issue, was born in that city on March 9, 1897. He began his career with the Milwaukee in 1914, serving successively at Milwaukee as a caller, machinist apprentice, machinist, gang foreman and night enginehouse foreman. Mr. Bunce went to Green Bay, Wis., in 1939 as enginehouse foreman and returned to Milwaukee in 1941 as day enginehouse foreman. From January 16, 1942, until his appointment as mechanical superintendent, he served in the following positions: enginehouse foreman at Ottumwa, Iowa, and at Milwaukee; assistant shop super-

intendent at Milwaukee and Minneapolis, Minn.; shop superintendent at Minneapolis; division master mechanic at Chicago, and as shop superintendent at Milwaukee.

Roy E. Baker, superintendent of car maintenance of the Boston & Maine, Maine Central and Portland Terminal, has been appointed assistant general manager of the three roads, with headquarters at Boston, Mass. Mr. Baker was born on February 20, 1901, at Meyersdale, Pa. He is a graduate of Pennsylvania State College (1923). Shortly thereafter he entered the employ of the Union Switch & Signal Co. at Swissvale, Pa. On June 16, 1925, he became an employee of the Boston & Maine at Boston. He was an air-brake instructor and supervisor of automatic train control until June 15, 1930, when he became general air-brake inspector. He was appointed supervisor of air brakes, air conditioning and power plants on September 1, 1939; principal road foreman and general supervisor of air brakes and train-control equipment of the B. & M. and Maine Central on July 1, 1943; assistant superintendent of the Fitchburg division of the B. & M. at Greenfield, Mass., on September 1, 1944, and superintendent of car maintenance of the B. & M., the Maine Central and the Portland Terminal on September 1, 1945.

R. E. Baker

Diesel

John N. Mathews, foreman Diesel shop of the Central of Georgia at Macon, Ga., has been appointed general Diesel supervisor, with headquarters at Macon. Mr. Mathews entered the employ of the Central of Georgia in 1923 at Macon where he subsequently served as a machinist specialist, machinist, machinist supervisor, machinist inspector, and machinist supervisor Diesel shop. He became foreman Diesel shop on August 25, 1946.

Charles P. Turner has been appointed system supervisor Diesel operation and maintenance of the Lehigh Valley, with headquarters at Sayre, Pa. Mr. Turner was previously Diesel service engineer with the American Locomotive Company at Schenectady, N.Y.

Electrical

L. J. Verbarg, electrical engineer, of the Missouri Pacific at St. Louis, Mo., has been appointed assistant to chief mechanical officer, with headquarters at St. Louis.

Car Department

John Gann has been appointed air-brake instructor of the Missouri Pacific at St. Louis, Mo.

Wallace E. Scragg, division general car foreman of the Boston & Maine and Maine Central at East Deerfield, Mass., has been appointed assistant superintendent of car maintenance, with headquarters at Boston, Mass.

E. J. Cox, car foreman of the Canadian National at Port Mann, B. C., has been appointed general car foreman of the British Columbia district at Vancouver, B. C.

James C. Marsh, assistant superintendent of car maintenance of the Boston & Maine and Maine Central at Boston, Mass., has been appointed superintendent of car maintenance.

Master Mechanics and Road Foremen

George Schepp, master mechanic of the Arkansas division of the Missouri Pacific at North Little Rock, Ark., has been granted a sick leave.

E. M. Vandiver has been appointed acting master mechanic of the Arkansas division of the Missouri Pacific at North Little Rock, Ark.

S. P. Byrnes, superintendent of motive power of the International-Great Northern at Palestine, Tex., has been appointed master mechanic of the Missouri Pacific Lines, with headquarters at San Antonio, Tex.

Shop and Enginehouse

L. C. Bryson has been appointed acting assistant superintendent of safety—shops and enginehouses of the Missouri Pacific with headquarters at Sedalia, Mo.

J. R. Hamilton has been appointed superintendent of shop (locomotive department) of the New York Central at Beech Grove, Ind.

Obituary

Albert Hubener, who retired in 1947 as superintendent of the Missouri Pacific shops at North Little Rock, Ark., died recently.

F. E. Lacey, master mechanic of the Missouri Pacific Lines at San Antonio, Tex., died recently.

W. D. Quarles, assistant chief of motive power, Atlantic Coast Line, died suddenly at Wilmington, N.C., on November 22.